

CITY OF MILWAUKEE, WISCONSIN  
DEPARTMENT OF PUBLIC WORKS  
BUREAU OF BRIDGES AND PUBLIC BUILDINGS

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SPECIFICATIONS

Consisting of

Part 3 - Bureau Requirements

Part 4 - Detail Specifications

for the

CONSTRUCTION

of the

W. ST. PAUL AVENUE \_ E. DETROIT STREET

VERTICAL LIFT BRIDGE

over

The Milwaukee River

To be located

on

W. ST. PAUL AVENUE & E. DETROIT STREET

between

N. PLANKINTON AVENUE and N. WATER STREET

in the

CITY OF MILWAUKEE

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JULY, 1965

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# DETAIL SPECIFICATIONS

Governing the Construction of the  
ST. PAUL AVENUE - DETROIT STREET BRIDGE  
over the  
MILWAUKEE RIVER  
in the  
CITY OF MILWAUKEE

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(See also "General Specifications of the Department of Public Works")

GENERAL WORK: The Contractors for this work shall refer to the "General Specifications" of the Department of Public Works as they shall be held responsible for all requirements made therein. Each contractor shall visit the site, consult the drawings and specifications, be familiar with the work of other contractors and determine for himself all conditions effecting the work.

Contracts for each branch shall include materials, labor, equipment and services necessary to complete the work. Any work normally a part of or reasonably incidental to a branch which is not required will be specifically stated.

INSPECTION CHARGES: Each contractor will be charged a fee for inspection for each and every day such inspection is required after the time allowed for completion has expired.

The amount of fee for each branch shall be as follows:

<u>Branch</u>	<u>Fee per day</u>
1. Excavation, Dredging, Cofferdams, Pile Driving, Concrete, Paving Approaches	\$50.00
2. Structural Steel & Machinery	50.00
3. Electrical Work	20.00
4. Hydraulic Equipment	20.00
5. Plumbing	10.00
6. Heating	10.00

The time allowed each branch for completion is stated in the Official Notice and shall start with the date stated on the Notice to Proceed with the work which will be sent to the contractor directly following the signing of the contract or for some branches, at a later date. The time allowance includes the time required for fabricating and procuring material and doing the work at the bridge site.

CONTRACT BREAKDOWN: Shortly after the award of the contract, each contractor shall submit a list showing the cost breakdown of the items in his contract. This list will be used as a basis for estimates of work completed for partial payments.

CONTRACT DRAWINGS: The drawings accompanying these specifications illustrate the nature and intent of the work and with the specifications form a part of the Contract Documents.

Wherever the clauses "as shown", "as directed", "as detailed", or similar expressions are used, it shall be understood that reference to the drawings is made.

WORKMANSHIP: The work shall be done in the best practice of the respective trade by competent mechanics. Tools and equipment shall be adequate, of proper type and in good condition. The Commissioner of Public Works or his representative shall have the right to reject work not in conformity with the contract documents or their intent, as well as work being improperly executed and the contractor shall repair or replace the rejected work as directed.

MATERIALS: Furnish materials of the types, qualities and characteristics specified. The specification of a trade name or manufacturer's name and catalog number is intended to establish quality, type, character and operating characteristic of the material required. Material by other manufacturers of equal specification will be accepted excepting as may be specifically stated otherwise.

Materials shall be delivered adequately protected, in merchantable condition and in original unbroken packages if normally packaged.

Materials shall be stored and handled so as to protect and maintain their merchantable condition.

The Commissioner of Public Works or his representative shall have the right to reject material not in compliance with specification as well as damaged material and the contractor shall remove such material from the construction site when and as directed.

APPROVALS: Wherever the words, "or equal", "or approved equal" or similar terms are used, it shall mean as approved by the Commissioner of Public Works or his agent. All drawings, bulletins and data necessary for an approval shall be submitted in quadruplicate to the Superintendent of the Bureau of Bridges and Public Buildings. Such approval shall apply to design only and shall in no way relieve this contractor from his responsibility for the full performance of his contract.

REVISIONS: The right is reserved to make modifications to a reasonable extent as bridge conditions may require, or as may be required to conform to code rulings.

CODE RULES: The rulings, regulations and laws of the following shall be complied with in the completion of this project:

Wisconsin Industrial Commission  
Plumbing and Drainage Codes of City of Milwaukee  
City of Milwaukee Bureau of Engineers Sewer Specifications  
City of Milwaukee Building Code  
Statutes and Building Codes of the State of Wisconsin  
Ordinances of the City of Milwaukee  
National Board of Fire Underwriters

SAFETY REGULATIONS: All work shall be done in accordance with the safety regulations set up by the Wisconsin Industrial Commission.

MANUFACTURER'S DIRECTIONS: Manufactured articles, materials or equipment shall be incorporated in the work, operated and maintained in conformance with the manufacturer's directions unless otherwise specified.

PROTECTION: The premises and the work shall be adequately protected from damage from the commencement of work to the date of final acceptance.

All damage shall be made good by the contractor or contractors causing same at his or their own expense.

SCAFFOLDING: Scaffolding shall be provided and maintained by the contractors requiring same and shall be removed when no longer needed.

GUARANTEE: Each contractor shall guarantee to replace or repair promptly at his own expense, as directed by the Commissioner of Public Works or his agent, all workmanship or materials in which defects may develop within one (1) year from the date of final acceptance of his work excepting as may be hereinafter specified.

PUBLIC UTILITIES: Before starting work each contractor shall investigate for interference with Public Utilities. Any extra costs involved with protecting said utilities shall be borne by said utilities, except for City utilities where such cost shall be included in the contract price.

CLEANING: Each contractor shall keep the work and area clean of rubbish, dirt and debris which shall be properly and carefully disposed of as approved or directed.

The work shall be cleaned of any and all blemishes and stains and left in a condition acceptable to the City within the normal limits of the work specified.

TEMPORARY WATER: Water shall be provided by the Plumbing Contractor near the bridge from a tap on the line which is to be used later to provide water for the bridge house. All water used will be paid for by the City of Milwaukee.

CONTRACTORS FIELD OFFICES: The street areas between Plankinton Avenue and the river and N. Water Street and the river may be used for the Contractor's field offices and storage of materials prior to approach grading, paving and utility work.

TEMPORARY TOILET: Before any work is started on the premises, the Branch 1 Contractor must provide for the use of all workmen at the bridge, in a place where directed, a 4'-0" x 4'-0" x 8'-0" building for temporary toilet accommodations with watertight roof, one window, and one door. The Contractor shall keep this temporary toilet clean at all times and remove same and all evidence thereof from the premises when so directed.

FIRST BRANCH  
(Including Project A and Project B)

Excavating, Dredging, Cofferdams, Marine Work,  
Pile Driving, Concrete, Sewer Work, Backfill,  
Fill, Operator's House, Asphalt Pavement, Paving  
on Filled Approaches

BRANCH NO. 1: Shall consist of Project A and Project B. Project A shall consist of all the substructure work including the dredging, excavating, cofferdams, marine work, pile driving, concrete, operator's house, sewer work, backfill, fill, concrete deck on steel beams, asphalt surfacing, etc. This contractor shall submit a lump sum bid for furnishing all labor and material to do all the work in this Project A as called for on the plans and in these specifications.

Project B is included in Branch No. 1 and consists of the concrete pavement from N. Plankinton Avenue to the West Abutment and from N. Water Street to the East Abutment including the grading, paving and related work. This Contractor shall submit unit price bids on this Project B.

The low bid of Branch No. 1 shall be determined by the sum of the bids on Project A and Project B and a contract will be awarded to one contractor for these two Projects.

PROJECT A included in Branch No. 1:

GENERAL REQUIREMENTS: Unless otherwise hereinafter specified or specifically noted on the drawings, all materials and details of construction shall conform to the requirements of "Standard Specifications for Highway Bridge, 1961" American Association of State Highway Officials.

SCOPE OF WORK: This Contractor shall be required to furnish all the labor, materials, tools and equipment necessary to do all the work included in the First Branch as shown on the plans and as herein specified. More specifically this Contractor shall:

1. Establish lines and grades from primary lines and bench marks established by the City.
2. Dredge the channel at the piers.
3. Provide adequate barricades at both approaches to the bridge.
4. Furnish place and brace the cofferdams for the four piers.
5. Furnish and place the steel sheet pile dock walls and anchor rods that are to remain in place at the abutments.
6. Drive steel bearing piles and wood anchor piles.



7. Excavate from within the cofferdams, place tremie seals, remove laitance and construct four concrete piers complete.
8. Construct the bridge operator's house complete including such details as doors, windows, stairs, roof, plaster, etc.
9. Place compacted gravel fill between new and old dock walls and build concrete abutments, concrete anchor blocks and retaining walls.
10. Extend sewers.
11. Arrange for placing of required utility lines.
12. Place compacted gravel fills for the approach pavement.
13. Place concrete deck and asphalt wearing surface on the steel approach spans.

DREDGING MATERIAL PERMIT: This Contractor shall obtain all the necessary permits to dispose of dredged materials and comply with all requirements of the U. S. Corps of Engineers.

RIVER TRAFFIC: River traffic on the Milwaukee River shall be maintained at all times without interruption. All Federal laws governing navigable waters shall be strictly complied with. The structural steel in the two spans east of the lift span may not be erected until the lift span is erected and operable to the extent that it can be raised and kept in the raised position at which time river traffic can move freely under and thru the lift span opening.

Therefore, the First Branch Contractor shall be and hereby is required to schedule his work so that Piers No. 2 and 3 and the operator's house are substantially completed by March 1, 1966 at which time the Second Branch Contractor shall commence the erection of the span.

Concurrently, on March 1, 1966 the Fourth Branch contractor shall commence installation of the auxiliary 5 H.P. gas-operated hydraulic lifting machine and the hydraulic cylinders and pistons so that the lift span can be lifted hydraulically as early in the month of April as possible and not later than May 1, 1966.

The navigational requirements will have hereby been satisfied and this contractor can proceed with the remainder of his work in a manner that will insure completion within the time allowance for this contract.

SCHEDULE OF WORK: This contractor shall submit a schedule of work prior to awarding of the contract which will give a breakdown of the work operations that insure compliance with the requirements set forth for river traffic and the time allowed for completion allotted in the Official Notice.



TIME ALLOWED: It is required that the bridge be opened to traffic on September 1, 1966. In order to attain this with certainty, a permit can be obtained from the Commissioner of Health to work on this project between the hours of 6 A.M. and 10 P.M. The contractor is expected to work these hours on portions of the work or use work forces and equipment which in the opinion of the Commissioner of Public Works, will accomplish this expediency.

PUBLIC UTILITY MAINS: Before proceeding with the work, the Contractor shall investigate all possible interference with public utility mains, conduits, etc. and make such arrangements as may be necessary for the proper prosecution of the work without damage to such structures. Any additional costs in the conduct of the work on account of protecting such structures against damage, however, shall be borne by the respective owners, except where such structures are owned by the City of Milwaukee, or Sewerage Commission, in which case, the additional costs shall be included in the contract price.

The following utilities are located in the vicinity of the new bridge and are as shown on our plans.

1. A 13' diameter M.I.S. Siphon sewer under the Milwaukee River from St. Paul Avenue to Detroit Street.
2. A 30" M.I.S. by-pass in St. Paul Avenue.
3. A 6'-3" x 2'-6" storm sewer in St. Paul Avenue.
4. A 15" sanitary in St. Paul Avenue.
5. An abandoned telephone cable under the river in St. Paul Avenue.
6. A 8'-6" x 4'-0" box storm in Detroit Street.
7. Two abandoned 24" gas mains in Detroit Street.

This information is not guaranteed as being correct or complete and this contractor will use all this information at his own risk and responsibility.

SUBSTRUCTURE:

EXCAVATION: The term "excavation" or "earth excavation" includes the removal of all debris, topsoil in the designated areas, earth, loose rock, old fill, trees and shrubs, concrete, etc. to be found within the spaces to be excavated. They shall be included as excavation or earth and removed by the contractor.

DISPOSAL OF MATERIAL: All material excavated and not suitable for backfilling or filling as hereinafter specified, shall be removed from the premises and disposed of by the contractor in accordance with City Ordinances.

Excess material that is suitable for backfill should be dumped on \_\_\_\_\_ as directed.

BACKFILLING AND FILLING: This Contractor shall furnish and place all backfill and fill material required on the site. Areas excavated shall be properly backfilled and the premises shall be brought to grades shown on plans in a manner hereinafter specified.

All backfill and fill between new steel dock walls and existing dock under abutment and back of the abutments and between the retaining walls shall be bank run gravel from the bottom of channel/or excavation level to the upper limits shown on the plan.

The front face of the retaining walls may be backfilled with suitable excavated material.

Bank run gravel shall consist of durable particles ranging in size from fine to coarse in a uniform combination. The presence of approximately ten per cent (10%) of fine clay or loam particles without lumps is desirable, but no boulders or stones above three (3) inches will be permitted. The gradation in size shall conform to the following requirements in percentage by weight.

Passing 2 inch sieve.....	95% to 100%
Passing No. 4 sieve.....	35% to 60%
Removed by decantation.....	5% to 15%

All bank run gravel backfilling and filling shall be done in horizontal layers not more than one (1) foot in thickness.

Each layer of backfill and fill shall be thoroughly compacted by means of a power driven, self-propelled, vibration type tamper as manufactured by the Jay Co. of Columbus, Ohio, or approved equal. Operator shall exercise caution when tamping near plumbing drainage piping and concrete work so as not to damage or move same. Any damage caused during backfilling shall be repaired in a manner suitable to the Commissioner of Public Works at the Contractor's expense.

STORM SEWER EXTENSION: This Contractor shall extend the 2'-6" x 6'-3" concrete box to the front face of the abutment wall. This construction shall be performed while the sewer is in service. The sewer may be partly dammed and the accumulated water from the normal flow pumped into the river, however, in the event of a heavy rain the dam shall be removed, construction stopped until the site can be pumped out, the area cleaned and then construction shall be resumed. Any damage caused by the rain shall be repaired in a manner satisfactory to the City's representative.

The concrete at the end of the storm sewer shall be cut back, the existing reinforcing steel cleaned, new reinforcing steel lapped and new concrete placed against this face.

This contractor shall extend the 30" M.I.S. cast iron pipe to the front face of the abutment wall. Remove concrete at the existing dock wall, lay the new C. I. pipe and band it onto the existing pipe. All sewer work shall be done in accordance with the Sewer Specifications of the City of Milwaukee.

DREDGING AND CLEANING: This contractor shall dredge or excavate, the river bed to 2 feet below the bottom of the concrete seal at each of the piers. This elevation shall be checked before placing the crushed stone base. The approximate amount of dredging may be determined from the soundings given on the drawing. The work may be done with a dipper dredge or clam shell bucket and the material excavated shall be disposed of on the dumping ground as set aside on blueprint File No. 1-L-1 submitted by the United States Engineer's office. Materials may not be deposited in the river during construction.

COFFERDAMS: The Contractor shall build the cofferdams for the piers, as shown on the drawings. They shall be constructed of steel sheet piling and must be watertight. The frame for the cofferdam must be held in perfect alignment during the driving of the steel sheet piles. The steel sheet piles are to be pulled except those sections that are to become part of the dock wall, or ties, as shown on the plans. Any defective material, workmanship, driving or other cause which will result in a leaky cofferdam shall be remedied by the Contractor without extra cost to the City.

All sheet piling left in place shall be new. Sheet piling for cofferdams to be removed may be second hand.

The cofferdams for the piers must be adequately braced inside as the water is pumped out, and must be sufficiently reinforced to insure a perfectly dry interior during the subsequent operations.

The Contractor shall submit drawings showing his proposed method of cofferdam construction and such other details as are left open to his choice or not fully shown on the plans. Such drawings shall be approved by the Engineer before construction is started, but such approval shall not in any way relieve the Contractor of his responsibility to secure a safe and satisfactory cofferdam.

No timber or bracing shall be left in the cofferdams in such a way as to extend into the substructure concrete without written permission from the Engineer.

The river bottom area within the cofferdams shall be excavated to elevation -29.0 and -33.0.

This contractor is to level off the soil at elevation -29.0 and -33.0 and place a two (2) foot thick layer of coarse crushed stone size No. 3 on top of which shall be placed a seal coat concrete which may be deposited under water by methods set forth hereinafter.

All concrete for main piers above elevation -22.0 and -26.0 shall not be deposited under water. Pumping to unwater a sealed cofferdam shall not commence until the seal shall have set sufficiently to withstand the hydrostatic pressure.

All concrete shall be placed in the dry. All water shall be pumped from a sump between the outside face of the forms and the inside face of the cofferdam. The sump shall be low enough to permit all water to flow by gravity into the sump.

EXISTING 13 FOOT DIAMETER SIPHON SEWER: The existing siphon sewer is located on the plans through computed alignment of existing records. This alignment should be verified by this contractor prior to the driving of any piles in the channel. This contractor shall auger 2 holes at each pier, abutment and end anchorage to elevation -45. One hole is to be north and one south of the existing siphon to confirm the location of the sewer. A temporary wood pile is to be placed in each of these holes and left as a guide until all permanent piles are driven after which they shall be extracted prior to the placing of the tremie concrete. If in augering the hole, contact is made with the sewer, the auger shall be moved and the process repeated. Any damage done to the siphon shall be repaired and paid for by this contractor.

MAIN PIERS: The main piers are to be of reinforced concrete supported on steel piles. The center piers are to have pits to receive the legs of the vertical lift span and the counterweights. Steel sheet pile cofferdams shall be driven around the piers providing enough space to completely form all outside surfaces. The steel bearing piles shall be driven practically to refusal as hereinafter specified. The concrete shall be placed in pours as shown on the plans.

No timber piles or material not properly a part of the main piers shall be allowed to project into the concrete.

A layer of coarse aggregate, size No. 3, shall be placed within the area of the cofferdam before the first pour of concrete is made.

RETAINING WALLS: Retaining walls shall be of reinforced concrete supported on steel bearing piles. Anchor rods, piles, timbers, bolts, etc. shall be installed as shown on the drawings.

END ANCHORAGE: This contractor shall place a concrete encasement at the top of the end anchor piles. A pipe sleeve shall be placed at each anchor rod. Trenches shall be excavated for each anchor rod and for the concrete anchorages. Holes shall be drilled through the existing concrete dock to permit lacing the anchor rods through. The holes shall be drilled in proper alignment so the anchor rods can be in a straight alignment from the dock waler to the concrete anchor.

STEEL SHEET PILES: The Contractor shall furnish the steel sheet piles including angles, plates, channels and bolts for all corners and special sections. The contractor shall fabricate all corners and special sections as shown on the plans. The Contractor shall furnish sheet piles of sections and lengths shown on the plans.

For the river piers, retaining walls, and docks the sheet piling shall be driven practically to refusal and the top elevation shall be at Elevation + 4.0 or higher. The sheet piling left in place shall be cut off as shown on the plans. Cutting shall be neatly done in a manner approved by the Commissioner. Material removed from the specified lengths of any sheet pile shall become the property of the City and shall be piled by the Contractor on the site as directed by the Commissioner for convenient disposal by the City upon completion of driving operations. If it is impossible to drive them in this elevation, they shall be neatly burned off to this elevation before concrete is placed.

The steel shall be made by the open hearth process.

The steel shall conform to the following requirements as to chemical composition:

Phosphorus not over 0.06 per cent.

Sulphur not over 0.06 per cent.

Copper not less than 0.20 per cent.

The steel shall conform to the following requirements as to physical properties:



Tensile strength, minimum, pounds per square inch .....	70,000
Minimum yield point, pounds per square inch	38,500
Minimum elongation in 8 inches per cent	<u>1,400,000</u>
	tensile strength

Bend test specimens shall stand being bent cold through 180° around a pin, the diameter of which is equal to twice the thickness of the specimen, without cracking on the outside of the bent portion.

All piling shall conform in other respects - test specimens, number of tests, finish, marking and inspection to the requirements of the Specifications for Steel for Bridges and Buildings of the A.S.T.M. Designation A-328 or the latest revision thereof.

At the west abutment this contractor shall cut openings in the sheet piling for the storm sewer outlets after the sheet piling has been driven. The steel sheet piling shall at no times prevent the flow of water from the storm sewer.

ANCHOR RODS: The sheet pile facing shall be tied to the anchor piles with anchor rods as shown on the drawings. Material for anchor rods, washers, etc. shall be wrought iron as hereinafter specified. The rods shall be straight and furnished full length with turnbuckle. The diameter of the hole in plate washers shall not exceed the diameter of the rod by more than 1/16 inch. The rods shall be carefully installed and the nuts for same properly tightened to provide as nearly as possible equal tension in each rod and to secure perfect alignment of the steel sheet piling. Pipe sleeves (A53-52) shall be used at the concrete anchor. All anchor rods shall be upset at ends.

BOLTS, WASHERS, BARS, ETC.: All bolts, anchor rods, nuts, washers, bars, etc. to be used in sheet pile anchorage shall be wrought iron as hereinafter specified. Washers shall be square cut, four (4) times the diameter of the bolt or anchor rod in size, and one-half the diameter of the bolt or anchor rod in thickness.

WALE TIMBERS: Creosoted oak timbers shall be securely bolted on the channel side of each center river pier as shown on drawings. The pieces at the ends of the piers shall be neatly rounded off and capped by a steel plate bolted or otherwise securely fastened to the timbers. This contractor shall furnish, fabricate and install all steel bars, bolts and washers which will be required for this work.

PAINTING IRON AND STEEL WORK: All anchor rods, bolts, nuts, washers, bars, channels, etc. in the substructure shall be given two shop coats of paint as hereinafter specified under "Materials". After erection all surfaces of anchor rods, nuts, washers, etc., which will be in contact with sand fill are to be touched up and be given one additional coat of the above paint. The second shop coat and the field coats are to be sufficiently tinted with lamp black so they can be distinguished one from another. Upon completion of concrete work all surfaces of exposed metal work including rubbing bars, washers, nuts, etc. shall be given one coat of black red lead paint as hereinafter specified under "Materials". Exposed faces of sheet piles, are not to be painted.

PAINTING TIMBER WORK: Immediately after all cutting and boring is completed and before final assembly, the cut surfaces of all creosoted timbers shall be given two (2) saturating coats of wood preservative oil, allowing at least two hours drying time between coats. Upon completion of the work a third and final coat shall be applied to all cut surfaces remaining accessible. The wood preservative oil used shall meet the requirements of the American Wood Preservers' Association Specification Pl-49, Grade 1, creosote oil. All painting shall be done only when the timbers are thoroughly dry.

GALVANIZED LADDER: Galvanized steel (A36) ladders shall be provided in the main pier pits. Ladder to be anchored to concrete with expansion anchors.

FRAME FOR SUMP PUMP: The frame is to be furnished and placed by this contractor.

STEEL BEARING PILES: The Contractor shall furnish steel bearing piles of sections and lengths shown on the plans.

All piles, or portions of piles, and cut-offs which are not required to remain in place shall become the property of the City and shall be piled on the site.

The steel shall conform to the Specification for Steel for the Bridges and Buildings of the A.S.T.M. Designation A36 or the latest revision thereof.

PILE DRIVING: All steel bearing piles shall be driven by a pile driver equipped with a Vulcan No. 1 or a super Vulcan hammer size 5,000 developing a minimum energy of 15,100 ft. lbs. or a pile hammer of approved equivalent capacity.

All wood piles shall be driven by a pile driver equipped with a Vulcan No. 2 single-acting steam hammer developing a minimum energy of 7,260 ft. lbs. or a pile hammer of approved equivalent capacity.



Adequate steam pressure must be maintained for the hammer to operate at its rated striking energy.

All wood piles and all steel bearing piles shall be driven to practical refusal.

Wood piles shall show a supporting power of not less than twenty (20) tons and steel bearing piles not less than fifty (50) tons as determined by the following basic formula:

$$P = \frac{2E}{S + .1} \text{ where}$$

P = Supporting power in pounds  
E = energy or foot-pounds per blow  
S = average penetration in inches per blow for the last few blows.

It is the rigid requirement of these specifications that all steel bearing piles be driven to the full lengths specified on the plans regardless of the 50 ton capacity requirement stated in the preceding paragraph.

All wood piles are to be driven to the full lengths as specified on the plans with the understanding that there is a two foot allowance for cut-off to remove the portion of the pile head that is broomed in driving.

The manner in which all piles are driven shall at all times be subject to the direction and approval of the Engineer. A complete record of each pile shall be made by the Contractor for the Engineer. This record shall contain all dimensions, elevation of point, and elevation of head of pile before and after cutting off. The record shall include the number of blows per unit of penetration prior to refusal.

The leads of the driver may be either of the fixed type rigidly fastened to the scow of the driver or of the swinging type suspended from a derrick boom, provided adequate facilities are provided to drive each pile perfectly plumb, or to the batter shown and in the exact location as directed by the Engineer.

Timber piles shall be pointed before driving and the head shall be sawed off square to the axis of the pile by removing a minimum amount of timber and then neatly chamfering to closely fit the base of the hammer. A special driving block shall be used when driving steel sheet piles.

If the heads of the piles tend to check or split under the hammer, the heads shall be wrapped with wire, or metal bands shall be applied to correct this condition.

The heads of all piles shall be protected, while being driven, with a cushion cap of approved design. Care shall be exercised to insure full bearing of the driving cap on the pile for proper distribution of the hammer blow.

Treated wood piles shall be handled with rope slings, taking care to avoid dropping, bruising, or breaking of the outer fibers, or penetrating the surface with tools. Sharp pointed tools shall not be used in handling treated piles or turning them in the leads. Steel piles shall be handled with care to avoid kinking the flanges.

All timber piles shall be squarely and accurately sawed off to sound wood, at the elevation indicated on the drawings. Piles to receive timbers, washers or other work shall in addition be neatly faced to a line to provide full bearing.

All steel bearing piles shall be cut off at the elevation shown on the plans and capped with a steel plate or reinforcing bars as shown in detail on the plans.

#### MATERIALS:

##### ANCHOR PILES:

##### 1. Kinds of Wood:

- All piles shall be of Douglas Fir and shall be creosoted as hereinafter specified.

##### 2. General Quality:

- All piles shall be free from any defects which may impair their strength or durability as bridge anchor piling, such as decay, red heart, splits longer than measured butt diameter of piles, twist of grain exceeding one-half of the circumference in any twenty (20) feet of length, unsound knots, numerous knots or holes, or shake more than one-third of the diameter of pile. Sound knots will be permitted provided they are not in clusters. The maximum diameter of a sound knot shall not exceed one-third of the least diameter of the section where it occurs, and shall not exceed four inches. A sound knot shall be one which at a depth not greater than its diameter shows wood as hard as that surrounding the knot.

All piles shall be cut from sound, live trees.

The butt and tip ends must be sound.

3. Dimensions:

- The piles shall conform to the following dimensions:

<u>Length in Feet</u>	<u>Diameter 3 ft. from Butt</u>		<u>Diameter of Tip</u>
	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>
35 to 50	12 in.	18 in.	6 in.

The diameter of a pile in cases where the tree is not exactly round, shall be ascertained by measuring the circumference and dividing the number of inches in it by the number 3.14.

Piles shall taper uniformly from the point of butt measurement to the top.

4. Tolerance

a. Diameters:

- A tolerance of 1/2 inch less in a given diameter will be allowed in not more than 25 per cent of the pieces of that diameter.

b. Lengths:

- A variation of 12 inches in length is allowable, but the average length must be equal to, or greater than, the length hereinbefore specified.

5. Straightness:

- Piles shall be free from short or reversed bends, and free from crooks greater than one-half the diameter of the pile at the middle of the bend. A line drawn from the center of the butt to the center of the tip shall lie within the body of the pile.

6. Manufacture:

- All knots and limbs shall be trimmed or smoothly cut flush with the surface of the pile. Ends must be cut square with axis of pile.

All piles must be peeled of bark including the inner skin soon after cutting so that the piles are smooth and clean.

7. Inspection:

- Piles will be inspected at suitable and convenient places satisfactory to the Superintendent of Bridges and Public Buildings, either at a point of shipment or at site of work. Inspector will make a thorough examination of each pile. Each pile shall be judged

independently without regard for the decision on others in the same lot. Piles too muddied for ready examination will be rejected. All piles shall be turned over and otherwise handled as inspected at the expense of the Contractor.

- All other costs of inspection shall be at the expense of the City.

TIMBERS: Oak timbers where specifically called for on the drawing shall be of red oak only and shall be creosoted as herein-after specified. Red oak timber shall comply with the National Hardwood Lumber Association standard specifications for #1 Common Sound and Square Edge timbers.

CREOSOTING: All anchor piling and timbers shall be given a twelve (12) pound full cell process treatment with A.W.P.A. (P1-49) Grade 1 creosote oil. Treatment shall comply with current standard specifications T1-49 and T3-49 of the American Wood Preservers Association for the Preservative Treatment of Piles and Timbers by Pressure Processes.

SCREW ANCHOR BOLTS: and plate washers for fastening timbers to concrete shall be of wrought iron hot galvanized after fabrication. The bolts shall be of the screw type with galvanized spiral shields concreted in place. The Contractor shall submit samples of the bolts he proposes to use for approval prior to placing order for same.

WROUGHT IRON: All anchor rods and bolts and ladder rungs shall be wrought iron complying with therequirements of the Standard Specifications for Staybolt Wrought Iron, Solid, Serial Designation A84-52 of the American Society for Testing Materials. All nuts, washers, bars, etc., shall be wrought iron complying with the requirements of the Standard Specifications for Refined Wrought Iron Bars, Serial Designation A41-36 of the American Society for Testing Materials.

GALVANIZING: Galvanizing shall meet the American Society for Testing Materials Standard Specifications for Zinc (Hot Galvanized) Coatings on Structural Steel Shapes, Plates and Bars and their Products, Serial Designation A123-47.

PAINT AND PAINTING: Paint for painting metal work shall be red lead paint prepared in accordance with Steel Structures Painting Council Paint Specifications; No. 2 Red Lead, Iron Oxide, Raw Linseed Oil and Alkyd Primer, S5PC-Paint 2 55T, January 1, 1955.

The formulation for this paint shall be as follows:

Pigment: (75 wt. % Min.) Wt. %

Red Lead	56.3
Red Iron Oxide	18.4
Aluminum Stearate	0.3

Vehicle: (25 Wt. % Max.)

Raw Linseed Oil	14.0
Alkyd Resin Solids	5.2
Driers and Thinners	<u>5.8</u>

Total	100.0%
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Spread at maximum rate of 450 Sq. ft. per gallon.

Black red lead paint where specified shall conform to the following formula:

<u>Ingredient</u>	<u>Wt. %</u>
Red Lead Pigment (dry)	31.3
Black Pigment (dry)	3.3
Prussian Blue Pigment (dry)	1.7
Raw Linseed Oil	58.9
Turpentine	2.4
Dryer	2.4

Paint to weigh approximately 11.6 lbs. per gallon.

## CONCRETE WORK

### Included in First Branch

CONCRETE WORK: This contractor shall furnish and place all concrete required for the satisfactory completion of all the work. This shall include all concrete work in connection with the construction of the main river piers, abutments, retaining walls, concrete anchors, approach span decks, operator's house, etc., all in accordance with the drawings and these specifications. Concrete required for roadway pavement, curbing and sidewalks on the filled approaches will be furnished and placed by this contractor, but under Project B.

### SAMPLES AND TESTS:

#### 1. Methods of Sampling:

- Samples of the cement and the aggregates, and samples of the mixed concrete may be taken at any time. These samples shall be selected, as far as practicable, in accordance with the standard methods for sampling materials, as specified in the standards of the American Society for Testing Materials.

#### 2. Costs of Tests:

- Tests on samples shall be made at the expense of the City, and the testing procedure shall in each case be in accordance with the standard methods specified in the requirements of the material under test.

#### 3. Uniform Materials:

- The Commissioner reserves the right to forbid the use of material from any plant or source, when the character of the material in such plant or source, or the mode of operation, is such as to make improbable the furnishing of reasonably uniform material.

#### 4. A.S.T.M. Standards:

- Wherever the abbreviation A. S. T. M. is used in connection with the number of a standard specification, the specification referred to shall be the standard specification of the American Society for Testing Materials designated by that number, including all amendments to such specifications that are in effect on the date of the award of this contract.

5. Testing Sieves:

- Sieves for laboratory analysis of materials shall conform to the Standard Specifications for Sieves for Testing Purposes (Serial Designation E11) of the A. S. T. M.

6. Commercial Screens:

- These specifications do not attempt to designate the sizes of screens that should be used in commercial plants. Material firms must adopt such screens and methods that will cause their product to conform to these specifications.

TYPES OF CEMENT:

1. Standard Portland Cement
2. Air-Entraining Portland Cement
3. High Early strength Portland Cement

REQUIREMENTS:

1. Standard Portland Cement shall comply with the Standard Specifications for Portland Cement, A. S. T. M. designation C150-44, Type I together with all subsequent amendments thereto.
2. Air-Entraining Portland Cement shall comply with the Tentative Specifications for Air-Entraining Portland Cement for Concrete Pavements, A. S. T. M. designation C175-44T, type 1A, together with the following amendments and additions:
  - a. Vinsol Resin is acceptable as an agent for treating Portland Cement under the terms of this specification.
  - b. The use of any other agent for the purpose of treating Portland Cement under the terms of this specification shall require written approval of the Commissioner of Public Works.
  - c. The Commissioner of Public Works reserves the right to reject any Air-Entraining Portland cement which does not produce a satisfactory air-entrainment in fresh concrete of between 3 per cent and 6 per cent by volume when such concrete is made with



6 sacks of Air-Entraining Portland cement per cubic yard of concrete, has a slump of 2" to 3" and is made in accordance with these specifications.

3. High Early Strength Portland Cement shall comply with the Standard Specifications for Portland Cement, A.S.T.M. designation C150-44, type III, together with all subsequent amendments thereto.

WHERE USED: For all concrete work, except footings, Air-Entraining Portland Cement shall be used. Standard Portland Cement shall be used for footings. In case the contractor desires to use High Early Strength Portland Cement in order to expedite the work, the use of same shall be approved by the Commissioner and the added cost shall be borne by the contractor.

FINE AGGREGATE:

1. Definition:

- The fine aggregate used in concrete shall comply with the requirements for Fine Aggregate as specified under A.S.T.M. C33, amended as follows:

2. General Characteristics:

- The fine aggregate shall consist of sand or other approved inert materials with similar characteristics or a combination thereof, and shall be composed of clean, hard, strong, durable grains.

3. Deleterious Substances:

- The maximum percentages of deleterious substances shall not exceed the following values:

Removed by decantation . . .	Not over $2\frac{1}{2}\%$ by weight
Shale. . . . .	Not over 1% by weight
Coal . . . . .	Not over 1% by weight
Clay lumps . . . . .	Not over $\frac{1}{2}\%$ by weight
Chert. . . . .	Not over $\frac{1}{2}\%$ by weight
Other foreign substances, such as,	
alkali, mica, ochre, coated grains,	
soft and flaky particles. .	Not more than 1% by weight

4. Decantation Test:

- The decantation test for clay and silt shall be made according to A.S.T.M. C117.

5. Organic Impurities:

- All fine aggregate shall be free from injurious amounts of organic impurities. Aggregates subject to the colorimetric test (A.S.T.M. C40) for organic impurities and producing a color darker than the standard shall be rejected unless they pass the mortar strength test hereafter specified.

6. Grading:

- Fine aggregate shall be well graded from coarse to fine, and when tested by means of laboratory sieves it shall conform to the following requirements:

Passing 3/8 inch sieve. . . . .	100%
Passing No. 4 sieve . . . . .	85% to 100%
Passing No. 16 sieve. . . . .	55% to 85%
Passing No. 50 sieve. . . . .	15% to 35%
Passing No. 100 sieve . . . . .	1% to 10%

Fine aggregate used for mortar shall have particles retained on a No. 8 sieve removed.

7. Workability:

- It is the intent of these specifications to secure aggregates that approximate the average of the above grading limits. When the concrete resulting from a mixture of aggregates approaching the extreme limits for gradation is not of a workable character or when finished does not exhibit a proper surface (frequently due to an excess of particles 1/8 to 1/2 inch in size), either a fine aggregate having a sufficiently greater percentage of fine material, or a coarse aggregate having a sufficiently smaller percentage of fine material, must be used.

8. Mortar Strength:

- Fine aggregates, when subjected to the mortar strength test, shall have a tensile or compressive strength at the age of 7 and 28 days of not less than 100 per cent of that developed by mortar of the same proportions and consistency made of the same cement and Standard Ottawa sand.

COARSE AGGREGATE:

1. Definition:

- The coarse aggregate used in concrete shall comply with the requirements for Coarse Aggregate as specified under A.S.T.M. C33, amended as follows:

2. General Characteristics:

- Coarse aggregate shall consist of a mixture of clean, hard, strong, tough, durable pebbles, and crushed pebbles, free from adherent coating, soft, flat or elongated particles, and free from vegetable or other deleterious matter. If the Contractor prefers, he may use crushed rock in lieu of the mixture of whole and crushed pebbles, provided that all other requirements of the specifications for Coarse Aggregate are strictly complied with.

3. Deleterious Substances:

- The maximum percentag of deleterious substances shall not exceed the following value:

Removed by decantation. . . Not over 1% by weight  
Shale . . . . . Not over 1% by weight  
Coal. . . . . Not over 1% by weight  
Clay lumps. . . . . Not over  $\frac{1}{2}$ % by weight  
Chert . . . . . Not over  $\frac{1}{2}$ % by weight  
Soft fragments. . . . . Not over 2% by weight  
Other foreign substances such  
as alkali, friable, thin,  
elongated, or laminated  
pieces . . . . . Not over 1% by weight

4. Grading, Separate Sizes:

- Coarse aggregate shall be furnished at the point where batches are measured in separate sizes as follows:

Size No. 1 (designated as No. 1 or 3/4" aggregate)

Passing 1" screen (circular openings) . . . . 100%  
Passing 3/4" screen (circular openings) 90 to 100%  
Passing 1/4" screen (circular openings) . 0% to 5%

Size No. 2 (designated No. 2 or 1½" aggregate)

Passing 2" screen (circular openings) . . . . . 100%  
Passing 1½" screen (circular openings) 95% to 100%  
Passing ¾" screen (circular openings) 0% to 20%  
Passing ½" screen (circular openings) . 0% to 5%

Size No. 3 (designated No. 3 or 2½" aggregate)

Passing 3" screen (circular openings) . . . . . 100%  
Passing 2½" screen (circular openings) 95% to 100%  
Passing 1½" screen (circular openings) 0% to 15%  
Passing 1" screen (circular openings) . 0% to 5%

The aggregate for each size shall be uniformly graded from coarse to fine with no intermediate sizes removed.

5. Workability:

- It is the intent of these specifications to secure aggregates that approximate the average of the above grading limits. When the concrete resulting from a mixture of aggregates approaching the extreme limits for gradation is not of a workable character or when finished does not exhibit a proper surface (frequently due to an excess of particles 1/8 to 1/2 inch in size), either a fine aggregate having a sufficiently greater percentage of fine material, or a coarse aggregate having a sufficiently smaller percentage of fine material, must be used.

6. Hardness:

- No aggregate shall be used which has a French co-efficient of wear less than five (5) when tested in accordance with A.S.T.M. D2.

7. Durability:

- Coarse aggregate shall pass a sodium sulphate accelerated soundness test, except that aggregate failing in the accelerated soundness test may be used if they pass a satisfactory freezing and thawing test.

8. Mixed aggregate:

- Crusher-run stone, bank run gravel or mixtures of fine and coarse aggregate shall not be used.

MIXING WATER:

- The water used in mixing the Portland cement shall be reasonably clear, free from harmful amounts of oil, acid, alkali, or vegetable substances and neither brackish nor salty. Water from City mains shall be used where available.

MISCELLANEOUS MATERIALS: Miscellaneous materials required for the satisfactory completion of the concrete work, such as: zinc and copper sheets, copper tubing, brass castings, etc., shall comply with the requirements of A.S.T.M. standard specifications. Zinc and copper sheets shall be furnished full length as required to provide a continuous watertight shield.

PROPORTIONING AND MEASURING BATCHES:

1. Stock Piling:

- The different sizes of coarse aggregate and the fine aggregate shall be stored in separate stock piles sufficiently removed from each other to prevent intermingling until after they have been proportioned in the designated amounts into each batch. Precautions must be taken to prevent contamination with earth or other foreign material; aggregate that has not been kept clean will be rejected.

2. Materials Measured Separately:

- The cement, fine aggregate, coarse aggregate, and admixture shall each be measured separately, for each batch of concrete. All necessary precautions must be taken to secure accurate quantities.

3. Measuring Devices:

- The batch hoppers, barrows, or other appliances used in measuring the fine and coarse aggregates shall be of such size and shape as may be approved by the Commissioner.

4. Weight Measurements for Batches of  $\frac{1}{2}$  Cubic Yard or Larger:

- Batches of concrete amounting to a volume of one-half ( $\frac{1}{2}$ ) cubic yard of freshly mixed concrete or larger shall be combined by measuring the constituent materials, including fine aggregate and each size of coarse aggregate, separately and accurately be weight. The weighing devices shall be of such type and so operated as to insure that variations of the quantities of each constituent in successive batches will not exceed two (2) per cent of the designated quantity. Weighing devices shall be equipped with indicating beams or dials which show the actual quantity of material used in each batch and which can readily be changed and checked.

5. Volumetric Measurements:

- Measurement of the fine aggregate and of each separate size of coarse aggregate, by volume, will be permitted when the volume of the batch of freshly mixed concrete is less than one-half ( $\frac{1}{2}$ ) cubic yard. In case this method is used, a cubic foot measuring box of approved type shall be provided by the Contractor and kept on the work at all times, for checking the measuring appliances.

6. Measuring Cement:

- One (1) bag of cement, amounting to not less than ninety-four (94) pounds, shall be considered as one (1) cubic foot. Cement shall be proportioned into each batch by full bags in which case the bags shall not be opened until the materials are delivered on the site of the work, or by weight in case bulk cement is being used. Weighing devices for bulk cement shall be accurate to within one-half ( $\frac{1}{2}$ ) per cent of the designated quantity of cement.

7. Change of Source:

- After production of concrete has been started with material from an approved source, no change or source of method of handling may be made except with the approval of or by direction of the Commissioner.

PROPORTIONS: CEMENT CONTENT:

1. General:

- The fine aggregate and separate sizes of coarse aggregate shall be combined into each batch for each class of work in proportions which will result in a concrete of maximum density and proper workability as determined by the Commissioner of Public Works.

2. Class "A" concrete for concrete deposited in water shall contain a minimum of seven (7) bags of High Early Strength cement per cubic yard of fresh concrete with coarse aggregates properly combined with the fine aggregate.

3. Class "C" concrete for all other concrete shall contain a minimum of six (6) bags of cement per cubic yard of fresh concrete with coarse aggregates properly combined with the fine aggregate.

4. Cement mortar for patching shall have approximately the same proportions as the mortar in the concrete on which the patching is done. Special precautions shall be taken by the Contractor to provide a mix matching the color of the concrete to which the patch is applied. Fine aggregate used for mortar shall have all particles retained on a No. 8 sieve removed.

#### MIXING CONCRETE:

##### 1. Mixer:

- The mixer shall be a batch mixer of approved type; it shall make not less than fourteen (14) nor more than twenty (20) revolutions per minute while mixing; it shall be equipped with a batch meter and a suitable regulated water measuring device. The charging skip shall be of proper size and shape to receive an entire batch and deposit it in the mixer drum without loss of material. The water valves and pipes must be in good operating condition, free from leaks.

##### 2. Machine Mixing:

- The aggregates and cement for all concrete and mortar mixtures shall be proportioned dry and deposited in the mixer, after which the water shall be added and the entire batch shall be mixed thoroughly for a period of not less than one and one-half ( $1\frac{1}{2}$ ) minutes after all the materials are in the drum. The entire contents shall be removed from the drum before any materials are placed therein for the next batch. No batch shall be larger than the rated capacity of the mixer.

##### 3. Retempering:

- No concrete shall be placed which has developed an initial set or has been mixed longer than twenty (20) minutes. Retempering with or without additional materials or water will not be permitted.

#### CONSISTENCY: WATER CONTROL

##### 1. Measuring Water:

- The water shall be measured or gauged accurately for each batch and shall be discharged automatically into the mixing drum.



2. Quantity of Water:

- Sufficient water shall be used in mixing to produce concrete of "quaking" consistency, but not as much as will cause it to flow or allow the mortar and coarse aggregate to separate. The quantity of water for each batch shall be as determined by the Commissioner for the purpose for which the concrete is intended and shall not be varied without his consent.

3. Slump Test:

- The consistency of the mixed concrete shall be such that when measured by means of the 4 x 8 x 12 inch Slump Cone, the slump shall not be less than three (3) inches nor greater than five (5) inches. The consistency of the concrete shall be tested and regulated by means of the "Slump Test" (A.S.T.M. C143). The Contractor shall provide the slump cone for testing and shall have it on the work at all times.

PLACING CONCRETE:

1. Condition of Forms, Etc.:

- In preparation for the placing of concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from the interior of the forms. The forms and surface of the concrete previously placed shall be thoroughly saturated with water before any concrete is deposited.

2. Condition of Concrete Reinforcement, Structural Steel, Etc.

- No concrete shall be deposited until the concrete reinforcement is held rigidly in exact position and the surface of same and that of structural steel and other parts of the work to be imbedded is entirely free from foreign matter to insure perfect adhesion of the concrete.

### 3. Depositing Concrete:

- The equipment shall be so arranged as to mix and place the concrete quickly and uniformly. In general, all concrete shall be deposited in horizontal layers of uniform thickness throughout and in such manner that the mortar and coarse aggregate are not separated.

The use of long troughs, chutes and pipes for conveying concrete from the mixer to the forms shall be permitted only on written authorization of the Commissioner. In case an inferior quality of concrete is produced by the use of such conveyors, the Commissioner may order discontinuance of their use and the substitution of a satisfactory method of placing.

No concrete shall be used which does not reach its final position in the forms within one hour after water is first added to mix.

Open troughs and chutes shall be of metal or metal lined where steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement. All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. Water used for flushing shall be discharged clear of the concrete already in place.

Concrete shall not be spouted into the forms at an angle, but shall be dropped vertically from hoppers and downspouts; the free fall beyond the end of the downspouts being held to not more than three (3) feet in order to prevent splashing. This shall be accomplished by the use of an "elephant trunk" extending down into the forms or similar arrangement approved by the Commissioner. Special care shall be taken to fill each part of the form by depositing the concrete as near the final position as possible. The coarse aggregate shall be worked back from the forms and the concrete forced around the reinforcement without displacing the bars.

Concrete shall be placed in horizontal layers not more than 12 inches thick unless otherwise directed by the Commissioner. When less than a complete layer is placed on one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding batch has taken initial set to prevent injury to the green concrete and avoid surfaces of separation between batches. Each layer shall be compacted so as to avoid the formation of a construction joint with a preceding layer which has not taken initial set.

All struts, stays, and braces inside the forms and serving temporarily to hold the forms in correct shape and alignment pending the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and not buried in the concrete.

After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of the projecting reinforcements.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, as in the sloped top surface of a wing wall, an inset form work shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 6 inches in the succeeding layer. Work shall not be discontinued within 18 inches of the top of any face, unless provision has been made for a coping less than 18 inches thick, in which case, if permitted by the Commissioner the construction joint may be made at the under side of the coping.

Immediately following the discontinuance of placing concrete all accumulations of mortar splashed upon the reinforcing steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the unset concrete. If the accumulations are not removed prior to the concrete becoming set care shall be exercised not to injure or break the concrete-steel-bond at and near the surface of the concrete, while cleaning the reinforcing steel.

Construction joints shall be placed across regions of low shearing stress, in locations which will be hidden from view to the greatest possible extent, and at only the locations shown on the plans or as directed by the Commissioner.

#### 4. Compacting Concrete with Mechanical Vibrators:

- In order to hold the proportion of mixing water to a minimum, the concrete shall be thoroughly consolidated by means of approved mechanical vibrators of the internal high frequency vibration type. At least two (2) mechanical vibrators shall be provided by the Contractor and kept in operation at all times during concreting operation. Special precautions shall be taken by the Contractor to insure thorough contact of the concrete with all portions of the steel reinforcement, structural steel, or other parts of the structure required to be imbedded in concrete. The concrete shall be vibrated in such manner to secure maximum density of the concrete, and the duration of the vibrations applied at any one point shall not be less than two (2) seconds nor more than five (5) seconds.

5. Depositing Concrete Under Water:

- Concrete shall not be deposited in water except with the approval of the Commissioner and under his immediate supervision; and in this case the method of placing shall be as hereinafter designated.

Concrete deposited in water shall be Class A with seven (7) bags of cement per cubic yard, this cement to be High Early Strength throughout. To prevent segregation, it shall be carefully placed in a compact mass, in its final position, by means of a tremie, a bottom dump bucket or other approved method, and shall not be disturbed after being deposited. Still water shall be maintained at the point of deposit and the forms under water shall be watertight.

For parts of structures under water, when possible, concrete seals shall be placed continuously from start to finish; the surface of the concrete shall be kept as nearly horizontal as practicable at all times. A pole with a wooden pad on the bottom end shall be used to check the elevation of the concrete. To insure thorough binding, each succeeding layer of a seal shall be placed before the preceding layer has taken initial set.

A tremie shall consist of a tube having a diameter of not less than 10 inches, constructed in sections having flanged couplings fitted with gaskets. The tremies shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and so as to permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of work so as to prevent water entering the tube and shall be entirely sealed at all times; the tremie tube shall be kept full to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete. The flow shall be continuous until the work is completed.

Unwatering may proceed when the concrete seal is sufficiently hard and strong. All laitance or other unsatisfactory material shall be removed from the exposed surface by scraping, chipping or other means which will not injure the surface of the concrete.

6. Construction Joints:

- The number and location of all construction joints not shown on the plans, together with the manner in which they are to be made shall receive the approval of the Commissioner prior to completion of the forms. As nearly as possible all concrete shall be poured continuously until completion.

In each horizontal construction joint in the main river piers, there shall be embedded a watertight shield consisting of a continuous 24 oz. soft copper strip twelve (12) inches wide riveted and soldered at joints. This shield shall be placed near the outside face of the pier to form a continuous watertight shield. Edges shall be snipped approximately one (1) inch deep at about four (4) inch centers and the copper alternately bent to provide a bond to the concrete.

In the piers, retaining walls, etc. suitable keyways shall be constructed at all construction joints to provide the maximum mechanical bond possible, and all reinforcing rods shall extend through the joint a distance sufficient to lap at least forty (40) diameters with the rods from the opposite side, unless the lap is specified otherwise. No oil or soap coating shall be used on forms for construction joints or keyways. At horizontal joints the surface of the concrete not occupied by key strips shall be swept with a stiff broom or wire brush from two to six hours after the concrete has been placed, and in such manner as to remove all trace of laitance and moderately roughen the surface. In the event all trace of laitance is not removed before the concrete has hardened, such laitance must be removed by chipping until sound concrete is revealed.

Immediately before concreting is resumed, the forms shall be drawn tight against the concrete already in place and the surface of the concrete shall be thoroughly cleaned with water under pressure and kept constantly wet for a period of at least one hour. After the surface wetness has disappeared,

a thick neat cement grout shall be forcibly applied with a stucco dash brush, followed within thirty minutes by the newly poured concrete. Special precautions shall be taken when spading or vibrating the concrete at construction joints to insure thorough contact of the newly poured concrete at the joint. When required by the Commissioner, the proportion of coarse aggregate used in the concrete at construction joints shall be reduced one-half.

READY-MIXED CONCRETE:

1. All requirements for materials, proportioning, mixing and other details governing the manufacture, delivery and quality of the concrete not specifically hereinafter set forth shall conform to the pertinent requirements for concrete hereinbefore specified.

The methods of delivering the concrete shall be such as will facilitate placing with the minimum of re-handling and without damage to the structure or concrete.

Transporting vehicles shall be so constructed as to insure rapid delivery without loss of ingredients. Vehicles used shall comply with State Laws and City Ordinances governing loads.

All concrete shall be mixed in a revolving drum type of mixer, whether stationary or movable. The mixing time or number of revolutions shall be as recommended by the manufacturer; but shall not be less than otherwise hereinbefore specified. The mixer shall not be loaded beyond the capacity recommended by the manufacturer.

The concrete as placed shall be of the consistency, workability, materials, and water contents as hereinbefore specified. Under no circumstances shall partially hardened or retempered concrete be placed in the work.

Special precautions shall be taken to protect the materials from damage during transportation under extreme weather conditions.

2. Central Plant-Mixed Concrete:

- The concrete shall be mixed in a batch mixer and in the manner hereinbefore specified before being loaded into the transporting vehicle.



The consistency of the concrete at the point of delivery shall be as hereinbefore specified and shall be free from segregation. Non-agitating type transporting vehicles shall not be used to transport central plant-mixed concrete when the consistency of the concrete is wetter than a  $2\frac{1}{2}$  inch slump. Remixing type transporting vehicle shall not be used to transport central plant-mixed concrete when the consistency of the concrete is wetter than a 6 inch slump. Agitating type transporting vehicles may be used without any restriction as to consistency.

The rate of delivery of the mixed concrete shall be such that the interval between loads shall not exceed 10 minutes. The period of time elapsing from the time of mixing until the time of depositing at the site of the work shall not exceed 45 minutes, providing, however, when this period exceeds 10 minutes mechanical agitators in the truck bodies will be required.

The concrete shall be delivered at the site of the work in truck bodies that are tight and clean. If necessary, to produce easy dumping, the sides and bottom of the truck shall be painted with paraffin.

### 3. Central Plant - Proportioned Truck-Mixed Concrete

- The truck mixer shall be of the revolving drum type so constructed as to produce a thoroughly mixed concrete with a uniform distribution of materials throughout the mass and shall be equipped with a discharge mechanism which will insure the discharging of the mixed concrete without segregation.

The procedure in loading the truck mixer shall be such that the cement and aggregate are uniformly distributed throughout the batch when the loading is completed. The cement and aggregates shall be fed simultaneously into the end-loading type of truck mixer.

The mixing water shall be accurately measured and controlled. Each batch shall be mixed not less than 50 nor more than 150 revolutions of the drum at the rate of rotation specified by the manufacturer as mixing speed. Any additional mixing shall be done at a slower speed specified by the manufacturer for agitation, and shall be continuous until the batch is discharged. Means shall be provided so that the mixing time and quantity of water added, can be readily verified by the Commissioner.



The rate of delivery of mixed concrete shall be such that the interval between loads shall not exceed 10 minutes. The concrete shall be delivered to the site of the work and discharged from the mixer and placed within a period of one hour after the introduction of the mixing water with the dry materials.

SURFACE FINISH OF CONCRETE:

A. Top Surfaces:

1. General:

Immediately after the concrete is placed, it shall be approximately leveled and struck off, compacted and finished with the surface true and smooth to the required grade and cross-section.

The strike-off templates and screeds shall be operated on approved forms or guides set and maintained to the required elevations of the finished surface.

Forms and guides shall be of substantial design capable of supporting the load placed upon them. The forms and guides shall be adjustable for maintaining the required camber and to allow for settlement under load.

Areas not reached by the strike gages and templates shall be accurately hand-finished to the required grade and cross-section. All laitance and water accumulating on the surface due to finishing operations shall be removed.

2. Float Finish:

After the concrete has been struck off as above described, the surface shall be thoroughly worked and floated with a wooden, canvas, or work float, the operation to be performed by skilled and experienced concrete finishers. Edges not provided with bevel strips shall be tooled to a  $\frac{1}{2}$ " radius if required by the Commissioner.

3. Trowel Finish:

After floating the surfaces as above described, the surface shall be troweled smooth and brushed lightly with a wet whitewash brush, the operations to be performed by skilled and experienced concrete finishers. Edges not provided with bevel strips shall be tooled to a  $\frac{1}{2}$  inch radius. The application of neat cement to the surface to hasten hardening is prohibited.

4. Wire Broom or Roughened Finish:

After floating the surface as above described the surface shall be slightly roughened by means of a wire broom. The entire surface shall be free from depressions, honey-combed portions and other irregularities.

5. Where Used:

Unless otherwise specified or noted on the drawings, all top surfaces of concrete not to be exposed upon completion of the work, such as footings and ledges for the support of pavement or sidewalks shall be given a Float Finish; all top surfaces of concrete to be exposed upon completion of the work, such as piers and retaining walls, copings, bridge seats, gutters, sidewalks, floors, landings, steps, etc., shall be given a Trowel Finish and the top surfaces of concrete to receive asphalt pavement shall be given a Wire Broom or Roughened Finish.

B. Surfaces in Contact with Forms:

1. General:

After the removal of forms all metal devices used to tie forms together and hold them to correct alignment and location, shall be removed in such a manner that no metal shall remain within less than one and one-half ( $1\frac{1}{2}$ ) inches of the surface of the concrete. The method of removal of any portion of the ties shall be such as not to cause excessive injury to the surface of the concrete by spalling.

All cavities produced by removal of form ties and all other holes, depressions and honeycomb spots shall be thoroughly saturated with water and carefully pointed with a mortar of cement and fine aggregate mixed in the same proportions used in the grade of concrete being treated and

of as dry consistency as it is possible to use. Mortar used in pointing shall be not more than one hour old, and shall be kept moist for a period of not less than 24 hours after it is placed. Considerable pressure shall be applied in pointing to insure filling all voids. Particular care shall be exercised to prevent honeycombing of concrete surface or insufficient covering of reinforcing. If, in the opinion of the Commissioner, any surface shows an excessive proportion of honeycomb and porous area or deep honeycombing, or where an excessive amount of steel is exposed, the condition shall be remedied by removing and replacing the defective concrete.

All joints in the completed work shall be left carefully tooled and free from mortar and concrete.

2. Ordinary Surface Finish:

The surfaces of all concrete masonry shall be thoroughly worked during the operation of placing by means of a concrete spading implement of an approved type. Spading shall be supplemented by vibrating as specified. The working shall be such as to force all coarse aggregate from the surface and thoroughly work the mortar against the forms to produce a smooth finish free from water and air pockets or honeycomb.

After the forms are removed and all pointing is completed and after the concrete is hardened, all fins and irregularities shall be removed by a carborundum brick. Should defects appear in the final surface, that in the judgment of the Commissioner, a satisfactory surface has not been secured, the Commissioner may order the contractor to rub-finish the surfaces of such sections as will produce a finished and workmanlike job. Except as otherwise required, all formed surfaces shall have an ordinary surface finish.

3. Rubbed Surface Finish:

Rubbed surface finish (see "Forms") shall be made by carefully rubbing the ordinary surface finish with a fine carborundum brick immediately after removing the forms. The first step in this process is to moisten the

surface with water, immediately following with the fine carborundum brick, rubbing in a circular motion. Only light pressure should be applied and the rubbing continued until all the air holes and small depressions are filled, and an excess of mulch is on the surface. The mulch should then be brushed out smooth with a long bristle paint brush. After the concrete has been rubbed smooth and has set for a period of from 5 to 8 days, it shall then be again rubbed, using a carborundum brick. Rubbing shall be continued until a smooth surface free from lumber marks and irregularities is obtained. In using carborundum brick, the surface to be rubbed may then be moistened with water to facilitate the rubbing; the fine material loosened by the brick may be used to fill the pores in the concrete. On warm days when the sun is quite strong, rubbed surfaces should be covered with canvas to keep the sun from drying out the surface too rapidly, thus causing the checking. Before final acceptance all lather, powder and dust left on finished surfaces by the action of brick shall be removed by rubbing with canvas when the surface is perfectly dry. The inside and outside faces at the Bridge Operator's House shall be given a Rubbed Surface Finish.

#### CURING AND PROTECTION:

##### 1. Curing:

- The top surface of all newly placed concrete shall be completely covered with twelve (12) ounce burlap or canvas as soon as the concrete has set sufficiently hard to prevent marring the surface. This cover shall then be kept continuously wet by light sprinkling for a period of not less than five (5) days. For sections of the work in which high early strength cement is used by the Contractor in lieu of ordinary cement the curing period may be reduced one-half.

##### 2. Removal of Forms:

- The newly placed concrete shall be protected against any appreciable loads other than workmen, hand tools, etc., for a period of not less than ten (10) days or as long as determined to be necessary by the Commissioner. For sections of the work in which high early strength cement is used by the Contractor in lieu of ordinary cement, this period may be reduced one-half.

Immediately upon removal of the forms, the surface of the concrete shall be finished as hereinbefore specified.

CONCRETING IN FREEZING WEATHER: Concrete may be placed in freezing weather, provided the following rules are strictly complied with by the Contractor. The Commissioner shall have the right to prevent any concrete from being mixed or deposited when in his opinion the temperature is too low, or the facilities for mixing, placing, and protecting are inadequate.

1. The initial temperature of the concrete, after having been put in place in freezing weather, shall be approximately 70° F., but shall not be allowed to fall below 60° F., nor to exceed 100° F.
2. The concrete so laid must be covered and protected from freezing temperature in a manner satisfactory to the Commissioner as soon as deposited in the forms. In cold weather heat shall be provided in the enclosure surrounding the concrete by the use of moist steam or other means approved by the Commissioner. The freshly laid concrete and the surrounding air shall be maintained at a temperature of 50° F. or greater and this protection shall be continued for at least seven (7) days. For sections of the work in which high early strength cement is used by the Contractor in lieu of ordinary cement, this time for protection may be reduced one-half. The methods of protection and curing shall be such as to prevent evaporation of moisture from the concrete and injury to the surface. Surface finishing shall be completed before the discontinuance of protection. Discontinuance of heating operations shall be arranged in such manner (subject to the approval of the Commissioner) as to avoid sudden temperature changes on new concrete work.

The method of heating the enclosure shall be such as will maintain the temperatures specified continuously with a reasonable degree of uniformity and without exposing the concrete to drying out or other injury due to excessive temperatures. A permanent temperature record shall be kept showing the date, hour, outside temperature, and temperature at several points within the enclosure to show the most favorable and unfavorable conditions to which the concrete is subjected. Unless otherwise directed by Commissioner, thermometer readings shall be taken at the start of the work in the morning and again in the late afternoon and the data so obtained shall be recorded in such manner to show the location of each reading and any conditions which might have an effect on the temperature. A copy of the temperature record shall be available

to the Commissioner at the close of each day's work.

3. To obtain concrete of the required initial temperature the materials to be used in mixing the concrete shall be heated as follows:
  - a. The water shall be heated to 90 degrees Fahrenheit or higher if the weather is very severe.
  - b. The fine aggregate, and, if necessary, also the coarse aggregate, shall be heated. Care shall be taken that the materials are heated as uniformly as possible. The degree of the amount of heating will depend on the weather and on the facilities for protecting the freshly poured concrete from freezing temperature. Coarse and fine aggregate shall, however, not be heated above a temperature of 150 degrees Fahrenheit. The cement shall not be heated under any conditions.
4. Temperatures shall be measured with thermometers of approved quality furnished and maintained by the contractor.

Any concrete which in the opinion of the Commissioner, has been damaged by frost shall be replaced at the expense of the Contractor.

Aggregates containing frost, frozen or hardened lumps shall not be used. The use of salt, chemicals, or other foreign materials to lower the freezing point of the concrete is prohibited. Concrete previously exposed to freezing temperature shall first be thoroughly thawed out to the satisfaction of the Commissioner before any concrete is deposited in contact with same. This shall apply also to soil, forms, steel, or other surfaces previously exposed to freezing temperatures.

FORMS: All forms shall be built mortar tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the opening of joints due to shrinkage of the lumber.

Surfaced and matched lumber, preferably not less than  $1\frac{1}{4}$  inches in thickness, and free from defects which would show in the finished work, shall be provided in direct contact with the concrete. For surfaces of concrete to be exposed upon completion of the work, or to be rub-finished (see "Rubber Surface Finish"), the forms shall be lined with new plywood, "Masonite", or equal, in order to reduce



hand finishing to a minimum. All joints shall be neatly fitted, and bevel moulding having  $3/4$  inch or 1 inch sides shall be used on all exposed corners unless otherwise shown on the drawings. Suitable keyways shall be constructed in all construction joints.

All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest possible size. The cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in color. Wire ties shall not be used.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall remain in place for periods which shall be determined as hereinafter specified. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the Commissioner shall order the work stopped until the defects have been corrected.

The shape, strength, rigidity, water-tightness and surface smoothness of re-used forms shall be maintained at all times. Any warped or bulged lumber must be re-sized before being re-used. Forms which are unsatisfactory in any respect shall not be re-used and shall be immediately removed from the work.

For narrow walls and columns, where the bottom of the form is inaccessible the lower form boards shall be left loose so that they may be removed for cleaning out extraneous material immediately before placing the concrete.

All forms shall be treated with oil or saturated with water immediately before placing the concrete. For rail members or other members with exposed faces, the forms shall be treated with an approved oil to prevent the adherence of concrete. Any material which will adhere to or discolor the concrete shall not be used.

CHASES AND CUTTING: As a general rule, chases and shafts have been provided for most of the ducts, but the Contractor for this work shall arrange promptly with the Commissioner of Public Works for all necessary additional chases, etc., to accommodate his work. The Contractor shall lay out his work to conform to space conditions, chases, shafts, and openings as shown on drawings to avoid unnecessary cutting. Contractor shall carefully watch the progress of carpenter, mason, and concrete work and shall be responsible for the proper location and dimensions of all chases and openings intended for its use. Where special chases, holes or other provisions are necessary for heating work, this Contractor must so indicate and arrange for same during construction of the building. This contractor shall give ample notice as to the size and location of any special openings necessary for bringing apparatus into the building or the handling of apparatus within the building. Contractor shall furnish the labor and material for work included in this contract in ample time and sufficient quantities so that all of the work may be installed in the proper sequence and so as to avoid the cutting of floor construction, walls, members, partitions, etc.



The Contractor for this work shall supply and set all inserts, thimbles, sleeves, bolts, hangers, forms, etc., as may be necessary for piping and duct work and attachments, etc. All cutting, patching, and excavation necessary to admit the heating work shall be done by this Contractor.

REINFORCEMENT:

1. General:

- The Contractor shall furnish and place all concrete reinforcement in accordance with the drawings and these specifications. Reinforcement for sections not specifically noted on the drawings but obviously required for proper design shall be determined by the Contractor and furnished and placed by him as approved by the Commissioner at no additional expense to the City.

2. Material:

- All concrete reinforcing bars shall conform to the requirements as specified under ASTM specification A-15 & A-305. They shall be made by the open hearth process and shall be of the class designated as "Deformed" and of "Intermediate" grade.

3. Protection of Material:

- Steel reinforcement shall be protected at all times from injury. When placed in the work, it shall be free from dirt, detrimental scale, paint, oil or other foreign substance.

4. Bending:

- The reinforcement shall be bent to the shapes shown on the plans.

5. Placing and Fastening:

- All reinforcement steel shall be accurately placed, and, during the placing of concrete, firmly held in the positions shown on the plans. Distances from the forms shall be maintained by means of spacers, high chairs, stays, blocks, ties, hangers, or other approved supports. Spacers and high chairs shall be of the welded wire type with tie wires attached.

SPLICES: Splices which are permitted shall have a length of not less than 40 times the nominal diameter of the bars, except where otherwise noted on the plans, and shall be well distributed or else located at points of low tensile stress. No splices will be permitted at points where the section is not sufficient to provide a minimum distance of 2 inches between the splice and the nearest adjacent bar or the surface of the concrete. The bars shall be rigidly clamped or wired at all splices in a manner approved by the Commissioner.

DAMPPROOFING: The following surfaces shall be dampproofed with materials and in accordance with construction methods hereinafter specified:

1. The backs of all concrete abutments, retaining walls, and miscellaneous walls to be in contact with earth or sand fill, including the tops of footings.
2. Outside faces of retaining walls from top of footing to a line at an elevation of the finished ground level. Surfaces above this line shall be protected against splatterings throughout dampproofing operations.

The surfaces specified shall be given one (1) coat of asphalt primer and two (2) coats of waterproofing asphalt in accordance with the A.A.S.H.O. Standard Specifications for State Highway Officials dated 1949, page 229. All materials shall be applied hot. A two (2) ply membrane not less than eighteen (18) inches wide shall be constructed over all construction and expansion joints, including center piers, in accordance with the above specifications. A caulking groove shall be provided in the concrete at the top edge of the membrane to prevent the infiltration of water back of same. A groove shall also be provided at expansion joints in which the membrane shall be folded to provide for expansion and contraction. Grooves shall be filled with an approved plastic cement consisting of semi-solid asphalt dissolved in a suitable volatile solvent and stiffened with short fiber asbestos. The asphaltic primer for the first coat shall conform to A.A.S.H.O. Designation M-116-42. The asphalt for the two coats of waterproofing shall conform to A.A.S.H.O. Designation M-115-42. The membrane fabric shall conform to the standard specification for Woven Cotton Fabrics saturated with Bituminous Substances for use in Waterproofing A.A.S.H.O. Designation M-117-40.

EXPANSION JOINT MATERIAL: Material used as a filler in expansion joints shall be preformed bituminous asphalt material to conform with the standard specification for Preformed Expansion Joint Filler for Concrete A.A.S.H.O. Designation M-33-48.

SEALING JOINTS IN CONCRETE WORK: All joints in concrete work exposed to the entrance of water from above shall have the edge or edges of the concrete rounded with a tool, and the joint sealed against the entrance of water by first priming with asphalt primer and then sealing with joint filler asphalt. The material used shall conform to the Standard Specifications for Mixed Asphalt and Mineral Filler A.A.S.H.O. Designation M-89-42.

SETTING OF ANCHOR BOLTS: To allow some play for the accurate setting of structural and machinery members over anchor bolts, only the lower parts of these bolts shall be solidly set into the concrete, whereas their upper parts shall be surrounded by standard wrought steel pipes to hold back the upper layers of concrete from packing against the bolts.

The bolts for anchoring of the base plates for the steel beams, base plates and anchor bolts for the hoisting jacks, the bearings for the machinery and the brackets for the wire cables will be furnished by the steel contractor and are to be set accurately by this contractor according to an approved anchor bolt setting plan furnished by the steel contractor. This contractor shall be responsible for keeping these bolts in the exact location during the placing of the concrete.

Furnish, fit, and set in place all other bolts where shown in the concrete. All bolts shall be complete with nuts and washers and set in formwork and cast in the concrete when it is poured so that the treaded ends will be exposed on the outside faces of the concrete.

The anchor bolts for the standby generator shall be furnished by the Generator Contractor and set by the Concrete Contractor.

GROUT FOR BASE PLATES:

The grout shall be composed of Standard Portland Cement Embeco (as manufactured by the Master Builders Company of Cleveland, Ohio) or equal, sand, and water in the following proportions:

- 1 part Standard Portland Cement (1 bag)
- 1 part Embeco (100 lb. drum)
- 1 part Sand (1 cu. ft.) and not more than  $5\frac{1}{2}$  gallons of water

The materials in the grout shall conform to the following requirements:

1. Standard Portland Cement shall comply with the Tentative Specifications for Portland Cement, A.S.T.M. Designation C-150-44, Type I, together with all subsequent amendments thereto.
2. Embeco, or equal, shall be as furnished by the manufacturer.
3. The sand shall comply with the requirements for fine aggregate as specified under A.S.T.M. Designation C33, and shall be composed of clean, hard, strong, durable grains free from deleterious substances.

The grout shall be proportioned accurately. It shall be mixed by hand, in small quantities, on a watertight wooden or metal surface of suitable size. The cement, Embeco and sand shall be mixed, without the addition of water, until a mixture of uniform color is produced. Then water shall be added, a little at a time, in sufficient quantities to produce the desired consistency and the whole mass shall be turned not less than six (6) times.

Prior to placing grout the concrete should be cleaned with liberal quantities of water. If oil is present, use strong, hot solution of Climalone or strong caustics to help clean the concrete. The concrete should present a roughened condition for good bond and it should be moist to assist the flow of grout and to prevent a rapid drying out of the grout.

Shims only of the size required to level the base plate will be permitted. Such shims are to be left in place.

The base plates shall be free of oil and grease and the structural steel work erected before any grouting is done. The grout shall be rammed, tamped, puddled or otherwise worked to eliminate air pockets and to insure even bearing under the base plates.

After the grout has attained the initial set, the edges shall be beveled neatly at a 1 to 1 slope from the base plate to the concrete foundation.

The surface area of the concrete foundation which lies outside the 1 to 1 slope of the grout shall be painted with clear varnish or shellac before the grout is placed.

No salamander heaters nor any vibrating machinery shall be allowed near the area where grouting is being done until the grout has attained its initial set.

Retempering of grout will not be permitted. Grout which has been mixed twenty (20) minutes shall be wasted.

Apply paint same as field coat to exposed edges of grout fourteen (14) days or more after the grout has been placed and/or when thoroughly dried out.

The temperature of the grout and the surrounding steel and concrete shall be maintained at about 70° F. at the time of grouting.

Grouting to be done only in the presence of the Commissioner's representative.

CLEANING STRUCTURAL STEEL, ETC.: All structural steel, etc., shall be thoroughly cleaned of all concrete splatterings by the Contractor prior to painting.

OPENINGS FOR DOORS: The contractor shall verify the openings for all doors with the detail drawings for the doors before making such openings. Also, check size of electrical cabinets to be installed at pier level in the operators' house.

ASPHALT SURFACING: This contractor shall furnish & place the asphalt wearing surface on the structural approach slab, Standard type sheet asphalt, using 1/4" maximum aggregate shall be used consisting of an asphaltic binder 1 1/2" thick and a sheet asphalt wearing surface 1 1/2" thick. Specifications of the City of Milwaukee, Bureau of Street Construction, shall govern.

JUNCTION BOXES: The contractor shall furnish and install a cast iron junction box at each of the light poles and as shown. The box shall be 18" x 12" x 6" x 3/8", type YT181206 as manufactured by the O. Z. Electrical Manufacturing Co. or approved equal. The box shall have a checkered covered plate with pry bar slots.

This contractor shall also furnish and install balance of cast iron junction boxes 12" x 12" x 8" x 5/16", type Y3121208 as manufactured by O. Z. Electric Company on bottom side of sidewalk slab. Drill and tap to receive conduits as shown. It shall have a hot dip galvanized finish, have neoprene gaskets and monel screws.

CONDUITS: The First Branch Contractor shall furnish and place all the conduits encased in concrete on the approach structural spans. Two 2½" dia. conduits on each of the spans (one at each curb) are for street lighting and one 2" dia. conduit on each of the spans is for Traffic Signals. Four (4) 1½" dia. conduits (2 on each side) for future gates and 3/4" dia. conduits to light poles for bells as shown. The conduits shall be standard galvanized rigid conduit.

## BRIDGE OPERATOR'S HOUSE

Included in First Branch

### SCOPE OF WORK:

The Contractor shall furnish all labor, materials, tools and plant of whatever nature required for the satisfactory completion of the bridge operator's house all in accordance with the drawings, and as set forth in these specifications.

The work embraces the following items:

- Hand Operating Bell
- Carpenter Work
- Plaster Work
- Precast Concrete Window Sills
- Resilient Flooring
- Masonry
- Precast Exposed Aggregate Panels
- Paint and Painting
- Windows
- Hollow Metal Frames and Doors
- Ceiling Scuttle
- Caulking
- Thresholds
- Turne Metal Roof

### HAND OPERATED BELLS:

This contract shall include the furnishing and installation of one hand operated bell as indicated on the drawings. The bell will be furnished by the city. All parts other than the bell itself will be furnished by this Contractor. The bell shall be hung on stainless steel standards made according to details furnished by this Contractor. These standards shall have proper bearings and adequate fastenings into the concrete wall and shall be so arranged to permit the bell to turn around completely when swung. Bell pulleys shall be made of bronze or stainless steel. The sleeve through concrete wall shall be stainless steel and bell cable shall be 1/8" diameter stainless steel flexible "Air Cord" as shown on drawings. Any other mechanical devices or parts required to make bell operable from control room to be furnished and installed by this Contractor. Shop drawing in triplicate to be submitted for approval before fabrication is commenced.

## CARPENTER WORK

Included in First Branch

SCOPE OF WORK: This Contractor shall provide and install all rough and finish lumber of every description for the superstructure of the bridge operator's house. Items included in this work are:



Wood roof framing and overhang  
Plywood fascia and roof  
Insulation, Control Room

ROOF AND CEILING FRAMING: This contractor shall provide and install all lumber for the framing of the roof and ceiling as indicated on drawings. All dimension lumber shall be No. 1 common Douglas fir (f 1200) dressed 4 sides. Roof sheathing to be 5/8" waterproof fir plywood, sheathing grade.

OVERHANG SOFFIT: All soffits for roof overhang shall be Weldwood Glasweld or equal as approved.  
Glasweld to be 3/16" thick  
Color to be selected  
Use Porcelain enamel covered aluminum mouldings with color the same as Glasweld.  
Panels shall be installed level and true to plan, free from warp or twist.  
Moulding channels shall be completely filled with sealant and the panel bedded firmly therein.  
Moulding shall be pre-drilled and nailed or screwed to wood blocking. Apply adhesive to back side of mouldings.  
Panels and mouldings to be cleaned of all sealants or dirt at completion of job.

INSULATION IN ROOF JOIST: The entire spaces between the steel channels and roof joists extending across the heads of windows shall be packed with loose Rockwool or vermiculite. ~~Loose Rockwool or vermiculite.~~

WALL INSULATION: All exterior plastered walls are to be furred out with 1" x 2" at 16" centers and insulated with 1" Fiberglass Roll Blanket with the aluminum foil vapor barrier.

PLASTER WORK: This contractor shall metal lath and plaster all insulated walls on the Control Room. Plastering shall not be started until electrical and heating ducts are in place. Plastering shall be done with Metal Lath. All plastering shall be three coat work, sanded at the mill. The finish coat to be fine sand float. The reveals shall have corner beads and corner-rites and shall be applied where necessary or as requested at interior corners.

PRECAST CONCRETE WINDOW SILLS: This Contractor shall furnish and install the concrete window sills and banding around the entire perimeter of the control room. The sills shall be poured to the contour of the house including straight sills and curved sills, mitered at the corners with holes for the columns. The materials shall conform to Federal Specification ss-s-721, Type I. Concrete shall be Class A, using 1/2" coarse aggregate with a minimum compressive strength of 3000 p.s.i. Reinforcement shall conform to Federal Specification qq-b-71a, Type B, Grade 2, 3, 4 or 5 and deformation shall conform to A.S.T.M. Standards A305-56T. The ends shall be roughened for bond. Precast concrete shall have an absorption of not more than 10% by weight after immersion in water 48 hours. Sills are to be sand aggregate with clean, sharp edges, simulating cut stone. Provide slots in sills for masonry anchors. Also

provide lug type anchors for installing same. All bed and vertical joints shall be 1/4" in width. The exposed joints on top of the sill where corner posts enter sill shall be filled with lead to a depth of 1/2".

### RESILIENT FLOORING

Included in First Branch

SCOPE OF WORK: Furnish labor, material, services and equipment for the complete installation of resilient tile flooring and cove base work and related work on Control Room Floor and Utility Room Floor as shown on the drawings and specified herein including but not limited to the following:

- Preparation of surfaces
- Resilient Flooring
- Top-set Rubber Base
- Samples
- Cleaning and Finishing
- Guarantee

RESILIENT TILE: Comply with Federal Specification L-T-00345 for Vinyl-asbestos tile and size shall be 9" x 9" x 1/8" thick. Tile shall be Vina-Lux Vinyl Asbestos Tile, 800 series, as manufactured by the Azrock Products Division, Uvalde Rock Asphalt Company, San Antonio, Texas, or approved equal.

Tile shall be first quality material, homogeneous throughout and consist of vinyl resin and high fire resistant and abrasive wear resistant asbestos fiber. Tile shall be free of blisters, cracks, embedded foreign matter, absorbent fibre or other defects affecting its appearance or serviceability.

Colors to be as selected.

Tile shall be capable of withstanding a furniture load of 75 p.s.i. without leaving a permanent visible mark after the load is removed.

Tile shall not creep under traffic.

Thickness tolerance shall not exceed .005" plus or minus.

TOP SET RUBBER BASE: Base shall be manufactured by manufacturer of rubber tile and be of equal quality. Base shall be rubber, 1/8" thick with molded top-set cove, with preformed end stops, internal and external corners.

Height shall be 4 inches and color standard as selected.

Rubber tile plinths shall be placed at all jambs and places of termination which are not wide enough to receive the rubber tile base.

ADHESIVE: Azrock Type Z cut back adhesive or adhesive suitable for installation on concrete slab on grade with radiant heating pipes.

WORKMANSHIP:

Preparation: Inspect surfaces and pertinent conditions affecting the work. The contractor will be held responsible for the satisfactory completion of the work after he has started work.

Fill holes, cracks, depressions, correct any conditions which will affect life and appearance of the flooring.

Clean surfaces and seal properly.

Application - Use only skilled mechanics. Conform to recommendations of the manufacturer of flooring.

Lay out work symmetrically in the areas, run joints straight. Scribe, fit to base snugly, cleanly.

All flooring shall lie in even level plane, in solid adherence to base. There shall be no surplus adhesive appearing.

MASONRY

Included in Branch 1

SCOPE: Furnish labor, materials, equipment and services necessary for the completion of masonry and related work shown on the drawings.

MATERIALS: Furnish whole and merchantable materials of the type and quality specified. The manufacturer's name and catalog number or specification shall be included with each material to establish quality, type and operating characteristics. Deliver material normally packaged in original unbroken merchantable packages clearly marked or identifiable. Deliver, handle and store materials so as to prevent damage or inclusion of foreign materials and maintain merchantable condition. Materials showing evidence of damage or determined to be damaged will not be acceptable and contractor shall remove them as directed.

The building is dimensioned on a modular basis. All materials including face brick shall conform to modular dimensions unless otherwise noted.

HOLLOW CONCRETE BUILDING UNITS: All units shall be lightweight non-load bearing conforming to Wisconsin State Building Code and A.S.T.M. C90-52, Grade A and shall be whole and merchantable, modular size, 7-5/8" x 15-5/8" actual size. Broken or chipped units will be rejected.

Light weight units shall be hollow, non-load bearing made from Portland Cement and Waylight, Haydite, or blast furnace slag aggregate. Cinder aggregate is not acceptable.

Provide special blocks for all corners, curves, piers, jambs, lintels, etc. Provide solid blocks or concrete brick for steel bearing.

Units shall be at least 90 days old after curing before use. The Contractor shall furnish a certification of the age of units before they may be built in.

QUARRY TILE STOOLS: Quarry tile stools for window sills shall be standard grade with corrugated back  $3/4$ " thick by 6" square with molded nosing of color to be selected.

MORTAR:

1. Materials:

Portland Cement - Conform to A.S.T.M. C150-52 A - Type I, B - White, Medusa or equal.

Lime: At contractor's option the following may be used:

1. A.S.T.M. C206-49, Type S, U.S. Gypsum Co., or equal
2. A.S.T.M. C207-49, Type S. Federal Specification SS-L 351, Type M, U.S. Gypsum Mortaseal or Western "Miracle" or approved equal.
3. A.S.T.M. C6-49, Type N, hydrated.
4. A.S.T.M. C5-26, Quicklime

Lime Putty:

1. Lime 1 and 3, slak 16 hours or more
2. Lime 2, mix with water at least 30 minutes
3. Do not slak
4. Lime 4, slak and age at least 10 days
5. Protect lime putty from exposure to sun and prevent evaporation.

Sand:

1. Fine aggregate, A.S.T.M. C144 grade coarse to fine, 100% passing #8 sieve and not over 30% passing #50 sieve
2. Pure silica sand or marble dust, grade coarse to fine, 100% passing #16 sieve and not over 30% passing #50 sieve.

Water: Clean and free from deleterious material.

Waterproofer: Integral type stearate as approved

- May be paste or liquid and contain at least 11.5% commercial stearic acid at least 85% pure. Compounds of potassium, sodium, clay, silicious clay lime, alumina and any other inorganic solids are not acceptable.

2. Mixing:

P. C. shall mean and intend Portland Cement  
L. P. shall mean and intend Lime Putty  
H. L. shall mean and intend Hydrated Lime

Use method of measuring material on job which will insure material proportions specified. For purpose of these specifications material weights shall be considered as follows:

<u>Material</u>	<u>Weights per cu. ft.</u>
PC	94 lbs.
HL	40 lbs.
LP	40 lbs. dry lime (solids)
	80 lbs. (dry)
Sand	85 lbs. (wet)

Prepare mortars containing PC in batches that will be used before initial set, and in no case longer than 45 minutes before delivery to mason's boards at point of use. Retempering of mortars will not be permitted. Mix cementitious materials and aggregate with a minimum amount of water to make the mortar workable. Except as approved for small batches, mix in mechanically operated batch mixers of the drum type in which water can be accurately and uniformly controlled. Mix dry materials at least two minutes and continue at least three minutes after water has been added. The mixer shall be maintained clean. The drum shall be completely empty before the succeeding batch is placed therein. For approved hand mixing, use a tight mixing box. Dry mix the materials to an even color then add water gradually until thoroughly mixed mortar of proper plasticity is obtained. Mortar in contact with ground will be rejected.

<u>Mortar Class</u>	<u>Proportions - Quantities in cu. ft.</u>					
	<u>PC-Type</u>	<u>HL</u>	<u>Sand</u>	<u>Type</u>	<u>28 day strength</u>	
M (A-1)	1 A	$\frac{1}{2}$	$4\frac{1}{2}$	1	2500 p.s.i.	
S (A-2)	1 A	$1\frac{1}{4}$	6	1	1800 p.s.i.	
N (B)	1 A	$2\frac{1}{2}$	9	1	750 p.s.i.	
BB	1 B	$2\frac{1}{2}$	9	2	750 p.s.i.	
Pointing	1 B	$2\frac{1}{2}$	9	2	750 p.s.i.	

Mix pointing mortar in small batches by hand. Add water-proofer to mortars for foundations and exterior walls as recommended by waterproofer manufacturer.

Use Class S mortar for masonry below grade, Class N for masonry above grade.

Use Class BB mortar for joints and beds adjoining sill.

Use Class BB mortar for laying structural facing tile. Mortars shall be non-staining (dirt resistant) to which ammonia stearate or calcium stearate is added to the amount equal to 3% of the weight of the cement used.

WALL REINFORCEMENT: Continuous trussed assembly of high tensile steel A.S.T.M. A-82-34, with 3/16 inch diameter deformed side rods and No. 9 gage diagonal cross rods with all joints butt-welded and the assembly galvanized. Widths shall be standard for wall thickness.

WALL TIES: Wall reinforcement specified in lengths of 24 inches or more.

CONCRETE FILLING: Bituminous reinforced fabric as manufactured by Sandell Co. of Woburn, Massachusetts, type SL or similar as approved.

#### Concrete Block Masonry

Use light weight concrete block throughout.

Lay blocks in running bond unless shown otherwise, with beds and joints approximately 3/8" wide with vertical joints plumb.

Joints and beds for standard blocks shall be completely full in face and cross shells; full in face shells only for light weight blocks. Fill joints and beds completely.

Bond each course at corners and intersections. Anchor to connecting structural tile work with metal wall ties placed at 16 inches vertically and 24 inches horizontally.

Fill jamb blocks for entire height at all openings completely with mortar or Class C concrete.

All block requiring cutting, trimming or mitering shall be saw-cut to provide perfect joints.

#### PRECAST EXPOSED AGGREGATE PANELS

Included in Branch 1

SCOPE OF WORK: Furnish all labor, materials, equipment and services necessary for the manufacture and delivery of the precast exposed aggregate panels and any related item herein specified, shown on the drawings, or both.

MATERIALS: Cement to be High Early Strength Type III conforming to A.S.T.M. C-150 as amended to date.

Use clean water free from injurious amounts of oils, alkalies, organic materials and other deleterious substances.

Except for graduation, the structural concrete aggregate shall conform to A.S.T.M. C-33. The maximum size of aggregate must pass a 3/4" screen.

Air entrainment agent for structural concrete shall conform to Corps of Engineers Specifications, Specifications ORD C-13, such as Darex AEA. Concrete shall contain not less than 3% or more than 4½% entrained air.



Aggregate for panel facing shall be granite or quartz. Color, type of aggregate, gradation, percent of each type, and exposure shall be approved by the Superintendent.

Reinforcing bars conform to A.S.T.M. A-305. Welded wire mesh shall be 6" x 6", 8/8 or 4" x 4", 10/10 complying with A.S.T.M. A-185.

FABRICATION: Panels must be factory cast, preferably indoors, for maximum quality control.

Cast the panels in horizontal forms of rigid construction which are straight, square, true and designed for a close control of dimensions and details as shown on the drawings.

Reinforcing to be placed as required complete with inserts.

Cast in the backside of the panels, "Bee-Hive" dovetail anchor slots, 20 gauge galvanized steel, at about 24" c/c vertically or two per panel. Mason Contractor shall install a minimum of 4 dovetail anchors per panel.

Structural concrete shall have proportion of cement, aggregate and water which will attain a minimum test cylinder strength of 4000 p.s.i., cube strength 7000 p.s.i. at 28 days.

Slump shall be maintained constant and in the range between 2" and 3½".

Use minimum amount of water necessary for good manufacture but not more than 5 gallons per bag of cement.

Moisture absorption of finished panel shall not exceed 6%.

Facing shall be of a minimum 1" thickness.

Work facing concrete into corners, around reinforcements, inserts, etc., and thoroughly vibrate to insure proper consolidation. As soon as practicable after casting expose the aggregate in the exterior exposed surfaces of the panel by means of chemical retarders, brushes, or other approved means. All exposed surfaces at window jams are to be exposed aggregate.

After casting, keep panels moist with wet burlap, use of approved curing membrane or other approved means.

Remove panels from forms within sixteen to twenty-four hours after casting.

Maintain moist or steam curing for a minimum of 48 hours after the removal from forms.

Apply 4% silicone waterproofing agent to exterior surfaces.

Provide finished returns at window jambs. Panel to be 2 1/8" thick.

Maintain casting, bowing, warpage and dimension tolerances in accordance with the following schedule.

1. Overall dimension (Height and width) plus 0.05% of panel dimensions, minus 0.10% of panel dimensions
2. Thickness: plus or minus 1/8"
3. Insert location: plus or minus 1/4"
4. Bowing or warpage: Where supplemental anchorage is furnished - 1/360 span. Where no supplemental anchorage is required - 1/240 span.
5. Edges will be square and true to the physical limits of the panel.
6. Provide 1/4" joints between panels and adjacent cut stones.

Patching of panels shall not be allowed.

SAMPLES: Furnish samples of each item if required.

SHOP DRAWINGS: Submit for approval shop and setting drawings of wall panels. Show in detail the dimensions and section of the various pieces.

INSTALLATION: Panels to be laid up by Mason Contractor.

Pointing Mortar to be Type BB.

Panels to be laid up and parged.

#### PAINTING - OPERATOR'S HOUSE

Included in First Branch

This Contractor shall furnish all the labor and materials for the complete painting in the Operator's House as specified including:

1. Walls and Ceiling - Control Room.
2. Walls and Ceiling - Utility Room.
3. Exposed ducts in above rooms.
4. Hollow Metal Doors.

APPLICATION: All paint shall be applied with brushes except the ceiling and walls may be brushed or rolled.

Painting Schedule: All catalog numbers, brand names, are for products of Pittsburgh Plate Glass Co. to establish type and quality.

1. Plaster - Walls and Ceiling  
Treat with zinc sulphate solution, 2 lbs. to one gallon water.  
Apply one coat primer UC-10341, 24-10.  
Apply one coat undercoater 50-26.  
Apply one coat enamel 50-16, color as selected.
2. Concrete and concrete block.  
One coat Speedhide Quick-Drying Emulsion Sealer (6-2).  
One coat Speedhide Interior Flat Emulsion Wall Paint.
3. Galvanized Ducts  
One coat galvanized steel primer.  
One coat Speedhide Semi-gloss enamel.
4. Hollow Metal Doors and Frames  
Two coats Speedhide Exterior or Interior Gloss Enamel.

CONTROL ROOM WINDOWS: The windows of the control room shall be extruded aluminum horizontal sliding windows equal to those manufactured by the Peterson Window Corporation, Ferndale, Michigan. They shall be furnished and installed complete with screens, all hardware, glazing strips, springs, anchors and weatherstrips.

All aluminum to be of 6063-T5 alloy with a minimum thickness of .062" in primary sections and 0.080" in sill sections. Exposed screws, axles, etc. shall be stainless steel.

The window shall consist of one or two fixed sash and one sliding sash, the frame and fixed sash being integral, the sliding sash to be removable for washing.

Provide mullion covers at columns.

Screens shall be furnished and installed and consist of a rewirable type aluminum frame and aluminum or copper screening.

Glazing: All windows shall be glazed with 1/2" insulating glass under this contract and an acceptable aluminum base caulking compound applied between the flange and double strength glass along with the glazing strips and springs furnished with the window.

Setting, Anchoring and Shop Drawings: The sash shall be set into and against corner posts and masonry as shown on drawings, and it shall be the duty of this Contractor to securely integrate and anchor the sash to the surrounds. Shop drawings shall be submitted in duplicate for approval showing method and means of such anchorage.

CAULKING: The entire perimeter of the window sash in contact with the metal or masonry shall be caulked.

PRESERVATIVE TREATMENT:

All lumber and plywood used in the operator's house shall be field treated with one heavy saturating brush coat of pentachlorophenol conforming to Federal Specification TT-W-570 mixed in a clean non-discolorating penetrating oil which will yield a paintable surface on drying.

HOLLOW METAL FRAMES

Included in First Branch

SCOPE OF WORK: Furnish labor and material for the manufacture, delivery and installation of the Hollow Metal Frames as shown on drawings.

GAUGE OF FRAMES AND ROUGH BUCK: 14 gauge.

MATERIALS: Steel for hollow metal work shall be the best quality open hearth steel furniture stock, full pickled, full cold rolled, double annealed, patent leveled, free from scale, pits or pitting, surface defects.

ENTRANCE DOOR PIER NO. 2: The rough buck and cabinet jamb shall be Williamsburg type RA and weather-proofed jambs type US1 and threshold type US7. The rough buck shall be anchored to the concrete with 2 unit expansion anchors.

ENTRANCE DOOR PIER NO. 3: Use the same as specified above.

DOOR PIER NO. 2 AT ELEVATION + 24.00: Use wraparound frame as manufactured by Williamsburg type WB-1.

Anchors - 3 adjustable tee anchors each side. Jambs are to have sill clips welded to frame and punched with two 3/8" diameter holes for anchoring to floor.

CONSTRUCTION: Execute, construct, fabricate the work at the shop and deliver ready for job erection. Prepare for necessary field connections and attachments by trial shop fitting. Provide holes, connections, fastenings for and to the work of other trades abutting, connecting, integrating or adjoining this work.

Conform to the best practice of the hollow metal industry. Weld connections and reinforcements and dress surfaces smooth.

Fit, fabricate accurately with surfaces free from warp, wave, buckle or other defects; make square corners, angles. Set members in alignment, true to plane and out of wind. Mitre corners.

Fit for finish hardware in the shop according to templates. Provide proper sinkages and mortises according to template so that hardware will fit neatly into depressions and finish flush. Drill and tap for finishing hardware in the shop.

Reinforcement: At hinges and lock locations 3/16" concealed bar spot-welded to inner surface of jambs. Reinforce for butts 8" longer than butts. Protect back of hardware cutouts and tapped reinforcement with metal plaster guards welded to frame back. Provide lateral stiffeners in openings over 42" wide.

Provide temporary spreaders as required.

PAINTING: Clean frames free from scale, rust, rough spots; apply shop coat of rust inhibitive primer before shipment. Painting Contractor shall do touch-up and finished field painting.

#### HOLLOW METAL DOORS

Included in First Branch

SCOPE OF WORK: Furnish labor, material, equipment, and services necessary for the manufacture and delivery of the hollow metal doors as shown on the drawings, specified herein, or both.

SHOP DRAWINGS: Submit shop drawings for work specified herein for approval. Manufacture the work in conformance with the approved drawings.

CONSTRUCTION: All doors, 1-3/4" thick, constructed in accordance with the requirements of Underwriters' Laboratories, and shall bear their label.

All doors shall be constructed from 14 gauge cold rolled stretcher leveled steel sheets; form edges to make mated pans; weld at seams. Rigidly connect, reinforce door inside with 18 gauge channels or Zee Bars properly spaced.

Join, reinforce both door edges full height with 10 gauge continuous strip as backup, offset at hinge locations, drill, tap to receive hinges. Completely weld edges; finish flush.

Doors to be made free of metallic ring; filled with asbestos.

Louvers shall be inverted V type, 85% free area, furnished and installed by Door Contractor.

All doors are to be Williamsburg type SFG or SFV as shown.

HARDWARE AND REINFORCEMENTS: Doors shall be mortised, reinforced (10 gauge), drilled and tapped for mortise type hardware in accordance with templates or physical hardware furnished by the hardware manufacturer. Reinforcement plates are to be provided for all types of surface applied hardware. All drilling and tapping shall be done in the field for such items as closers, stops, escutcheons, kick plates, etc. All finish

hardware shall be applied in the field.

SHOP FINISH: After assembly, all doors are to be thoroughly cleaned and finished. All welds and joints to be ground smooth and filled flush with mineral filler so as to conceal all seams.

Doors are to receive two coats of a light gray, zinc chromate, rust inhibitive primer baked on.

This Contractor shall furnish and install all hardware.

LOCKS AND LATCHES: Shall be Schlage "D" line, Plymouth design. Backset shall be 2-3/4 inches for all locks and latches. Strikes shall be box type with wide enough lip projection to protect door frame but not to exceed 3/16 inches beyond face of frame. All locks and cylinders shall be of one manufacturer and shall have not less than 6 pins.

BUTT HINGES: Shall be Stanley Ball Bearing, non-rising loose pin, flat bottom tip unless specified to contrary. Provide 3 butts per door. Butt size shall be 5" x 5".

DOOR BUTT LEGEND:

- Exterior doors BB193
- Thresholds: Rixon #400, 3-3/4" x 1/2"

DOOR CLOSERS: Shall be as manufactured by LCN Closers, Inc. of proper size as described in manufacturer's schedule of sizes. Where parallel arm or weather strip is specified, closers shall be one size larger than manufacturers recommendations. Where possible, closers shall have key adjusting device. Furnish 6 adjusting keys. Mount to provide maximum opening permitted by building construction or equipment and not on schedule this maximum swing per location for other trades involved in reinforcement or installation. All door closers shall be similar in design and appearance and so far as possible of one manufacturer. Closers with fusible link arms mounted on a bracket must be furnished with "Filler Strips."

CEILING SCUTTLE: This contractor shall furnish and place a steel access door in ceiling of Control Room. It shall be Milcor Style K(20" x 30"). Painting shall be by this Contractor.

CAULKING

Included in Branch 1

SCOPE OF WORK: This Contractor shall furnish and place all the caulking shown on the plan or specified herein:



- Caulk joints between mullion and sash.
- Caulk joints between sash and soffit.
- Caulk joints between sash and exposed aggregate panels.
- Caulk joints between door frames and rough opening.
- Caulk joints between soffit and vent grilles.
- Door Saddles.
- Concrete to concrete joints where shown on plan.

PREPARATORY WORK: Clean joints to be caulked free of mortar and other foreign matter. For joints to be caulked between masonry units, rake out mortar at least 3/4" deep from finished surface and leave clean.

Prime sides if joint to be caulked. Place caulking material.

MATERIALS:

1. Primer: Quick-drying clear varnish thinned to proper consistency and of type recommended by caulking manufacturer. Apply with brush.
2. Caulking: Gray for use with gun.
  - a. Silka Chemical Corp. - Caulking Compound.
  - b. Armstrong Co. - Caulking Compound.
  - c. A. C. Horn Co. - Vulcatex.
  - d. Tremco Mfg. Co., Inc. - Caulking and Pointing Compound.

JOINTS: Neatly point joint with beading tool. Remove excess material. Make joints waterproof. Clean any adjacent materials that have been soiled.

TERNE METAL ROOF

Included in First Branch

SCOPE OF WORK: This Contractor furnish all the labor and materials to place a Terne metal roof on the Bridge Operator's House including the following:

- Install rosin-sized paper.
- Install terne metal roof.
- Lock all seams standing seam.
- Solder all flat seams.
- Paint roof.
- Roofing Ternes
  - Gauge of Steel
    - a. Roofing Sheets - IX gauge painted two sides, and as manufactured by Follansbee Steel Corporation or equal.
  - Tin Coating:
    - a. Weight of coating shall be 40#
    - b. Coating shall be made of pure block tin and lead, and it shall be evenly distributed over the sheets.
    - c. Finish of coating shall be oil.

Paper:

- Cover all roof under ternes with rosin-sized paper.

Paint for Terne Roof:

- a. Prime coat for both sides of ternes shall be made of red lead, mixed with pure linseed oils, at least 40% of which is kettle boiled.
- b. Finishing coats shall be made of lead base with pure, open kettle boiled linseed oil.

Solder:

- a. A.S.T.M. B32, 50% pig lead, 50% block tin.
- b. Flux: Rosin only shall be used as a flux for soldering.

LAYING AND WORKMANSHIP: TERNE ROOF

Inspection:

- All defects found in surfaces prepared by other trades shall be reported in writing. The commencing of work by this contractor indicates his acceptance of the surface.

Terne Roof

- Cover all surfaces to receive roofing ternes with rosin-sized paper, lapping all seams at least 2" and nail securely.
- Sheets 20" wide shall be laid flat, locked with a standing seam and each sheet notched and edged 1-1/2" and 1-1/4".
- Sheets shall be laid the narrow way, and each shall be secured to the roof with cleats 8" on center on the long sides and 1 cleat on the short side. Cleats shall be 1-1/2" wide and hooked over the edge and nailed to the roof with two nails to each cleat. Hammer all seams smooth and lock carefully.

TESTS:

- For leaks, proper operation, expansion, etc.
- If any faults are found this contractor shall repair or replace any parts he has furnished or installed without additional cost to the City of Milwaukee.

RUBBISH REMOVAL:

- Remove all rubbish such as cartons, crates, or any other debris caused through this work from premises or as directed by the Inspector.

DAMAGE TO OTHER WORK: This contractor shall repair any work damaged by any of his work operations without additional cost to the city.

PROJECT B INCLUDED IN BRANCH 1  
Governing the Construction

of the

PAVED APPROACHES

on St. Paul Ave.

from N. Plankinton Ave. to the West Abutment

and on Detroit St.

from N. Water Street to the East Abutment

All work on this Project B shall be done according to the Street Construction Specifications of the City of Milwaukee dated January 1, 1963, and the plans for paving which are a part hereof.

The fill shall be placed in controlled compaction in accordance with section 4.1.4. of the Street Construction Specifications.

SECOND BRANCH  
Structural Steel and Machinery

STRUCTURAL STEEL WORK: This Contractor shall furnish and erect all the structural steel and aluminum for the satisfactory completion of the work as shown on the plans.

LOADING: The bridge has been proportioned for the following loads and the Contractor shall design all details to conform to same.

Dead Loads - Estimated weight of structure.

Live Loads = All parts of the structure were designed for H20-S16-44 truck loading of the American Association of State Highway Officials, 1961.

UNIT STRESSES AND PROPORTIONING OF PARTS:

General:

- All parts of the structure shall be so proportioned that the unit stresses will not exceed those allowed by the A.A.S.H.O. Standard Specifications for Highway Bridges dated 1961. Unless otherwise hereinafter specified or specifically noted on the drawings, all material and details of construction shall conform to the requirements of the A.A.S.H.O. Standard Specifications for Highway Bridges, dated 1961.

STRUCTURAL STEEL MATERIAL: The steel material for the main girders with lifting legs, the plates and angles for the finger expansion joints shall be low alloy steel conforming to A.S.T.M specification A242.

The steel grating shall be copper bearing steel conforming to A36 (0.20% minimum copper).

The drainage troughs shall be either Cor-ten or Mayari-R steel.

The balance of the structural steel shall conform to A.S.T.M specification A36.

The welding electrodes shall conform to A.S.T.M. Specification A-233; rivets shall conform to A.S.T.M. Specification A-141 and high strength bolts shall be A-325 friction type.

GENERAL WORKMANSHIP: All parts shall be fabricated in accordance with the drawings. Unless otherwise specified, the workmanship and finish shall conform to the A.A.S.H.O. Standard Specifications for Highway Bridges, 1961.

STRAIGHTENING MATERIAL: Before being laid out or worked in any way, the material shall be thoroughly straightened in the shop by methods that will not injure it.

STRENGTH OF CONNECTIONS: Connections shall have a strength at least equal to that of the members connected, regardless of the computed stress. Connections shall be made as nearly as practicable, symmetrical about the axis of the members.

ANCHOR BOLTS: This contractor shall furnish all anchor bolts. The anchor bolts may be placed in the concrete at the time the concrete is placed or holes may be drilled in the concrete and the bolts grouted in place. If bolts are placed at the time the concrete is placed they must be set true and accurate with a template. An anchor bolt setting plan shall be provided to the First Branch Contractor for his use.

EXPANSION JOINTS: Provision for expansion shall be made at the piers and abutments in floor as shown on the drawings.

The clearance to be provided is indicated on the drawings for a temperature of 60 degrees Fahrenheit. This clearance must be adjustable to accommodate the actual temperature at the time of erection.

WELDING: All welding shall conform to the "Standard Specifications for Welded Highway and Railway Bridges" of the American Welding Society, including pre-qualification of welders.

BEARING PLATES AND ROLLERS: This Contractor shall furnish all bearing plates and rollers as shown on the plan. The material for the bearing plates and rollers shall conform to the A.S.T.M. Specification Designation A36. Rollers shall be turned down from a solid bar. For all plates in contact with rollers the edges adjacent to the collars shall be rolled or finished. The surface of all plates in contact with rollers shall be finished.

STEEL ROADWAY DECKING ON LIFT SPAN: This contractor shall furnish and erect all the steel decking on the lift span.

The roadway deck on the lift span shall be an open steel mesh grating of unbroken and uniform pattern continuous in all directions as shown on the drawing.

It shall be made of alternate straight or carrying bars and shallower bent or bracing bars (arranged on edge with all top edges flush so as to present a level, smooth surface for traffic) the latter to be securely riveted at 5" intervals along the former.

Carrying bars shall be  $2\frac{1}{2}$ " x  $\frac{1}{4}$ " and crimped bars shall be  $1\frac{1}{2}$ " x  $\frac{3}{16}$ " A.S.T.M. A36 copper bearing steel (.20% min. copper). Rivets shall be of  $\frac{3}{8}$ " diameter, cold-driven.

The angle between the straight and bracing bars shall be between 60 and 80 degrees. No decking bar may be at right angles to the direction of traffic, nor shall there be any sharp angles that may damage automobile tires.

The decking shall be furnished in units fabricated in such manner as to permit end-splicing and side-splicing together on the job, so as to form one continuous pavement free from joints and of uniform pattern for the length and width of the roadway.

In order to protect any long projecting ends of bars which may form the splices, from damage in shipment, they shall be properly banded, boxed or reinforced in some suitable manner.

The field splice shall be made with  $\frac{3}{8}$ " diameter cold-driven pointed rivets so disposed as to be headed by a tool operated from the top surface and without the use of a scaffold.

Tools necessary to effect this field splice shall be loaned, free of charge, by the decking manufacturer to the Contractor making the installation.

The completed splice must show at least 115% of the strength of the unspliced portion in actual test by a recognized laboratory, copy of such test to be submitted upon request of the Commissioner.

Straight bars, at point of splice, shall overlap at least  $5\frac{1}{2}$ " and these overlaps shall be fastened together with at least three  $\frac{3}{8}$ " cold driven rivets.

This decking shall be designed to support H-20-S16 loading with 30% allowance for impact on a 18" span.

The decking shall be given one coat of red lead paint as herein specified as shop paint for structural steel.

The decking shall be installed with the straight bars running parallel to the direction of traffic.



It shall be fastened to every aluminum joist with special steel clips and galvanized bolts as shown on the plan.

Weight of decking, including splices, shall not exceed 17.6 pounds per square foot.

The design of decking upon which bid is submitted must have been in satisfactory use on another bridge for at least three years.

Workmanship to be perfect in every way - rivets to be driven home tightly and with proper heading, reticuline bars to make perfect contact with adjoining straight bars for a distance of at least 9/16" on both sides of rivet centers, and top edges of all bars to be perfectly flush.

STEEL CASTINGS: All steel castings shall conform to A.S.T.M. specification A27-52T, Grade 65-35. All patterns used are to become the property of the City of Milwaukee.

STRUCTURAL ALUMINUM MATERIAL: The aluminum alloy for the stringers, joists, lateral bracing and connections shall be 61-T6 conforming to the "Specifications for Structures of a Moderate Strength Aluminum Alloy of High Resistance to Corrosion" of the Proceedings of American Society of Civil Engineers.

The sidewalk plate shall be aluminum alloy 5154 and be abrasive tread plate as manufactured by Alco or approved equal.

The Fabrication shall conform to the "Specification for Structures of a Moderate Strength Aluminum Alloy of High Resistance to Corrosion" as stated above.

DRAWINGS: Shop detail drawings shall be furnished by the manufacturer to the City for approval. Erection drawings shall be furnished to the City for use in assembling and erecting material in the field.

HANDRAILING: This Contractor shall furnish and erect all metal handrailing required.

The handrailing shall be made of steel tubing and the workmanship shall be ornamental in character. All parts of the railing shall be accurately cut, fitted, welded and assembled in such a manner that when erected it shall present a neat finished appearance. The assembled sections of railing shall be set true to line and grade, the posts set plumb and the base plates and rails conform to the longitudinal grade of the sidewalk, retaining walls, stair stringers, etc. Ends of the handrail sections shall be hermetically closed by 1/4" plate welded in place and edges ground smooth after welding. The posts shall be welded to the base plate in the field.

Before the railing is fabricated, field measurements shall be made to determine the exact length and elevation, and shop drawings shall be submitted to the Superintendent of Bridges and Public Buildings for approval.

SHEET LEAD PLATES: The sheet lead plates for the handrail shall conform to the requirements for common desilverzie Lead A, A.S.T.M. Designation B-29-43.

CAMBER OF ROLLED BEAMS: The main girders of the lift span and all the beams on approach spans shall be cambered in the rolling mill either while hot or in a straightening jig after cooling, and or in the fabricating shop by use of heat or hydraulic jacks. If done in the fabricating shop, the cambering shall be done by workmen who are skilled and experienced in this type of work, the heat or jacks being applied at sufficient points, but not less than three, to produce a smooth unbroken curve over the full length of the beam with no apparent distortion or upsetting of the section. The amount of finished camber shall not vary more than  $1/4$ " less nor  $1/2$ " more than that specified on the plans. During the shipping and erection, care shall be taken to insure the maintenance of the camber. The amount of camber shall be equal to the vertical curve of the grade of the roadway plus the dead load deflection.

The aluminum stringers need not be cambered but shall act as a series of short chords. They shall be straightened.

BEND IN END FLOOR BEAM: The end floor beam shall be bent at the center to take the contour of crown of the roadway. This can be bent with heat or with hydraulic jacks or the beam may be cut, veed and welded with a full penetration butt weld and ground smooth.

BEAM LENGTH ON APPROACH SPAN: The beams on the approach span are longer than are normally rolled. In the event that a splice is desired this contractor may submit a plan for this alternate method for producing the length of beam required to the Superintendent of Bridges and Public Buildings for approval.

LIGHT POLES: This contractor shall furnish and install the aluminum light poles with transformer bases at the location shown on the plans. The poles shall be 7.5" x 4" x 25'-0" and shall have a wall thickness of 0.188". The single bracket arm shall have a bracket spread of 8'-0" and shall be made of 2" standard pipe size aluminum tubing with a standard 2" pipe thread. The pole shall be Union Metal Monotube design 102C, catalog number A7D40-250-C1 or approved equal. The pole shall be set vertical by means of a beveled shim placed on the sidewalk.

## ERECTION OF STRUCTURAL WORK

PLANT: The Contractor shall provide all tools, machinery, and appliances, including field rivets, high tensile strength bolts and welding electrodes drift pins and fitting up bolts, etc. necessary for the expeditious handling of the work.

HANDLING AND STORING MATERIALS: The Contractor shall unload material promptly upon delivery. Material shall be placed on skids above the ground. It shall be kept clean and properly drained. Girders and beams shall be placed upright and shored. Long members, such as columns, shall be supported on skids placed near enough together to prevent injury from deflection.

MAIN GIRDERS AND FLOOR BEAMS: The main girders of the lift span shall be erected in such a manner that the end floor beams can be placed. The two center girders shall be erected in the first instance after which the end floor beams shall be placed through the slots provided in the main girders and temporarily connected with bolts and angles. The outside main girders shall then be erected followed by the intermediate floor beams, stringers, brackets, lateral bracing, etc.

All steel members shall then be properly aligned and adjusted and held with erection bolts after which all welding and final connections shall be made.

### PAINT AND PAINTING:

#### General:

- Except as otherwise hereinafter specified, all structural steel, aluminum, handrailing, machinery, and other metal work shall be painted in accordance with the A.A.S.H.O. Standard Specifications for Highway Bridges.

All structural work shall be painted in the shop after fabrication and before exposure to the weather. After erection, all field rivet heads, bolts, field welded surfaces, damaged areas shall be touched up by this Contractor with a paint of the same quality as was used for the shop coat. No structural steel or aluminum shall be painted until it has been shop inspected and approved by the Commissioner's representative. In riveted work, contact surfaces are not to be painted. Surfaces between angles not in contact but which will be inaccessible after riveting, shall be given two (2) coats of red lead paint. Before painting, all of the work shall be thoroughly scraped and brushed on all surfaces, and all mill scale, rust and dirt removed using approved stiff scrapers and wire brushes and all greasy surfaces shall be carefully cleaned with benzine before painting. Before removing from the shop, all structural work shall be given one (1) coat of red lead paint well brushed on. All erection marks shall be on painted surfaces. All paint must be dry when the material

is loaded on cars or trucks for transportation to the job site.

No painting shall be performed upon damp or frosty metal or in wet or foggy weather. All painting found to be defective shall be scraped off and repainted as the Commissioner's representative may direct. Before final acceptance and after erection, all damaged surfaces of paint shall be cleaned and repainted to the satisfaction of the Commissioner's representative.

SHOP PAINT: (For structural steel, handrailing and machinery). The shop coat or primer shall be "Red Lead Primer" in accordance with Steel Structures Painting Council Paint Specifications No. 2 Red Lead, Iron Oxide, Raw Linseed Oil and Alkyd Primer, SSPC-Paint 2 55T, January 1, 1955.

The formulation for this paint shall be as follows:

Pigment (75 wt. % min.)	Wt. %
Red Lead	56.3
Red Iron Oxide	18.4
Aluminum Stearate	0.3
Vehicle: (25 wt. % max.)	
Raw Linseed Oil	14.0
Alkyd Resin Solids	5.2
Driers and Thinners	5.8
Total	100.0%

Spread at maximum rate of 450 sq. ft. per gallon

For Aluminum: (Shapes, plates and light poles)

All aluminum surfaces except the top exposed abrasive tread sidewalk plate shall be painted one coat of zinc chromate primer in the shop. All contact aluminum surfaces shall be given one coat of zinc chromate primer. Zinc chromate primer shall be allowed to dry before assembly of the parts. Zinc chromate primer shall conform to United States Navy Department Specifications 52P18 or the equivalent.

Paint shall not be applied when the average daily temperature of the air is less than forty (40) degrees F. Material painted under cover in damp or cold weather shall remain under cover until dry or the weather conditions permit its exposure in the open. Painting shall not be done when the metal is hot enough to cause the paint to blister and produce a porous paint film.

CLEANING AND TREATMENT OF ALUMINUM SURFACES: All surfaces of aluminum shall be cleaned immediately before painting by a method which will remove all dirt, oil, grease, chips and other foreign substances.

The surfaces shall be cleaned by either chemical cleaning or sandblasting.

1. Chemical Cleaning:

- Parts may be immersed in, or swabbed with a solution of phosphoric acid and organic solvents diluted with water in the ratio of 1:3. The solution temperature shall be between 50° F. and 90° F. The solution shall remain in contact with the metal not less than five minutes. Residual solution shall be removed with clear water.

2. Sandblasting:

- Standard mild sand blasting methods may be used on sections more than 1/8" thick.

For contacting surfaces only, the metal may be cleaned with a solvent such as mineral spirits or benzine.

Flame cleaning is not permitted.

NON-HARDENING JOINT COMPOUND: The steel surfaces to be placed in contact with aluminum are to be given one coat of a non-hardening joint compound known as Alumilastic, manufactured by the Parr Paint & Varnish Co., of Cleveland, Ohio or an approved equal.

FIELD PAINT: After touching up is completed all metal work shall be painted two (2) finish coats of Rustoleum No. 831 Restful Green, Pittsburg Ironhide or Dupont Dulux Metal Protective Paint in a color comparable to the above mentioned restful green. The paint shall be applied at a maximum rate of 450 sq. ft. per gallon.

The first field coat shall be tinted with two (2) oz. of Lamp-black in oil conforming to Federal Specifications TT-L-71 to each gallon of paint.

The paint shall be well ground, shall not settle or cake appreciably in the container, shall be readily broken up with a paddle to a paint of smooth, uniform, and good brushing consistency. When brushed on a smooth, vertical, iron surface, the paint shall not break, run, or sag; shall set to the touch in not more than four (4) hours, and shall dry hard and elastic in not more than twenty-four (24) hours at a temperature of approximately seventy degrees Fahrenheit (70° F.).

This Contractor shall see that caps on alemite fittings are in place before painting.

All electrical equipment in operator's room, equipment at switchboard, etc. must be cleaned, polished, refinished, varnished or painted, as may be directed, so as to have a finished surface after installation.

All panel boxes, support boxes, pull boxes, etc. except for iron work refinished as specified above, shall be given two coats of black asphaltum paint on the inside, with all outside surfaces painted as may be directed. Boxes, etc. having a grease film shall be treated with ammonia before the application of paint.

APPLICATION: Painting shall be done in a neat and workman-like manner. Paint shall be applied with brushes. Brushes preferably shall be round or oval, but flat brushes may be used if they do not exceed four (4) inches in width. The paint, when applied shall be so manipulated under the brush as to produce a uniform, even coating in close contact with the metal or with previously applied paint and shall be worked into all corners and crevices. On surfaces which are inaccessible to paint brushes, the paint shall be applied with sheep-skin doublers specially constructed for that purpose.

JOINT SEALER: The joint between the sidewalk plate and the expansion joint plate shall be filled with a non-staining joint sealer as specified on the plan.

LIFTING LEGS: The Lifting Legs together with the main girders shall be fabricated and erected in a true vertical plane. All joints shall be completely welded, straightened and stress relieved so that when the Lift Span is raised the legs will operate in a true vertical plane. Guide Rails with Guide Wheels operate on the outside legs.



SCUPPERS: This Contractor shall furnish and place the scupper, grate and downspout. The City has in storage at the Bridge Shop, 400 W. Traser Street, patterns for the scupper and grate that may be used. Before any castings are made these patterns shall be carefully checked and reconditioned to produce castings which are in every way equal to those from new patterns. All patterns whether new or reused, upon completion of the work, shall be cleaned and re-shellacked and delivered to 400 W. Traser Street.

OPERATORS HOUSE: This contractor shall furnish and install all structural steel for the bridge house as shown on the plans including the railing, signal ball, staff, sheaves, brass flanges, wire cable, etc. The square posts at the corners which support the roof structure shall be fastened to the concrete wall by means of anchor bolts through the base plates. The anchor bolts shall be furnished to the first branch contractor together with a setting plan for his use in placing the anchor bolts. The channel roof shall be field connected.

SIGNAL BALL: This contractor shall furnish and install a 16" diameter signal ball as indicated on drawings, complete with staff, disappearing device, chains, pulleys, etc. The ball shall be made in 16 segments of 24 gauge galvanized iron ARMC0 Paintgrip or equal and shall be given three coats of paint equal to Rustoleum #960 primer and #1210 finish coats. The 2" diameter pipe on which the ball slides shall be brass and the exterior fastenings for this pipe shall be of stainless steel. The ball capping this pipe shall be of cast bronze enclosing a pulley. The patterns for this casting and the roof and ceiling castings will be furnished to the Contractor by the City. Other materials and details for construction and operation of the signal ball shall be as shown on the drawings.

BRONZE NAME PLATE: One (1) bronze name plate shall be furnished and placed by this contractor as shown on the plan. This contractor shall drill holes in concrete and anchor to concrete with expansion anchors.

MOUNTING PLATES FOR CAMS OR ELECTRICAL CONTROLS: This Contractor shall furnish and place all the mounting plates on the structural steel for attaching cams for limit switches, etc.

MACHINERY  
Included in Second Branch

SCOPE OF WORK: This Contractor shall furnish all labor, materials, tools, and equipment of whatever nature required for the satisfactory installation of all work included under this branch, all in accordance with the drawings, these specifications and code rulings.

More specifically this contractor shall furnish and install the following:

1. Shafts
2. Shaft bearings
3. Gears
4. Couplings
5. Lubrication system
6. Machinery bolts, nuts and washers
7. Collars
8. Wire ropes and fittings
9. Sheaves and drums
10. Thrust bearings
11. Counterweight
12. Patterns
13. Guide wheels and rails

GENERAL: The machinery required is primarily for a wire rope, shaft and gear equalizer system.

All machinery shall be proportioned, designed and constructed in accordance with the best modern practice. The workmanship shall be first-class, and the machine work shall be accurate, so as to avoid excessive hand fitting. It is expressly understood and agreed by the Contractor that the erection and adjustment of any and all machinery shall be superintended by expert millwrights, etc. and shall be performed only by skilled mechanics, familiar with and experienced in the accurate erection of heavy machinery. Ample allowance for variations from dimensions and drawings shall be made in preliminary operations on machinery parts and their supports, to provide for final drilling, reaming, fitting, etc.

No surfaces shall be marred by hammering on either tooled, rolled, or cast surfaces. If it is necessary to strike a piece, in order to adjust it, a cushion of soft metal or other material shall be placed between it and the hammer.

All surfaces coming in contact shall be tool finished and shall be true and smooth. The mark "f" on the plans denotes a finished surface, and all symmetrically located or similar surfaces shall also be finished even though each such surface is not specifically marked. Where two abutting surfaces are represented by a single line marked "f" both of the surfaces shall be finished. All parts shall be well fitted together. All moving joints shall work freely but without needless lost motion. Every moving joint shall be provided with an approved grease fitting.

Exposed finished or semi-finished edges of castings, shall be chamfered. In semi-finished edges, the minimum chamfer shall be  $1/8$  inch at 45 degrees.

Where press fits are called for the actual diameter of the male part shall exceed the corresponding calipered diameter of the female part by an amount not less than  $0.0008 XD$  and not more than  $0.0012XD$  in which  $D$  = the diameter in inches.

Where a drive fit is called for on bolts, the diameter of the hole shall in no case exceed the diameter of the bolt.

In all other cases where drive fits are called for the diameter of the male part shall exceed the actual calipered diameter of the female part by an amount not less than  $0.0004XD$  and not more than  $0.0008XD$ . Where push fits are called for the actual diameter of the female part shall exceed that of the male part by an amount not less than  $0.0002XD$  and not more than  $0.0006XD$ .

Where running fits are called for the allowance in diameters shall be that specified under "Shaft Bearings and Journals".

Where holes to be fitted with turned bolts, pins, etc., are called for on the City of Milwaukee drawings, it is to be drilled and reamed with an allowance for reaming (which allowance shall be provided for on the shop drawings), such that the finished reamed hole shall be straight and true to the size required. The bolt, pin, etc. shall be made with such variation from the diameter of the hole as required by the character of fit called for.

Wherever castings must be assembled against structural parts before the connecting holes can be finished, the holes in the castings shall be drilled in the shop for a light driving fit for turned bolts and one sixteenth larger than the normal diameter for rivets and the holes in the structural parts shall be left blank unless otherwise directed by the Commissioner.

Joints between structural plates and all principal machine cast steel or cast iron parts of the machinery shall be milled.

Castings shall be spot-faced for bearings of bolt heads and nuts.

SHOP ASSEMBLY: All of the machinery for the equalizer systems, and guide systems, etc. shall be assembled in the shop to ascertain the fit of the shafts in the journal-blocks, the accuracy of the alignment and the center-to-center distances, and of the different parts.

All parts of each group of machinery shall be match-marked while assembled in the shop.

MATERIALS:

General:

- Unless otherwise herein specified or specifically noted on the plans, all materials shall conform to the requirements of the A.A.S.H.O. Standard Specifications for Highway Bridges, dated 1953 and the American Railway Engineering Association Specifications for Movable Bridges.

Material for Bolts

- Material for bolts shall conform to the standard specifications for "Steel for Bridges and Buildings" A.S.T.M. serial designation A36-52T. Cold rolled steel shall not be used for bolts in tension.

Material for Pins:

- Pins shall be made of rolled structural conforming to the standard specifications for "Steel for Bridges and Buildings," A.S.T.M. serial designation A36-52T, with the additional requirements that they shall be annealed before machining. Cold rolled steel shall not be used.

Steel Castings:

- Steel castings shall be A.S.T.M. A27-52T, Grade 65-35, annealed.
- For determining the effect of annealing and reannealing, suitable projections shall be provided on the castings. Several such projections shall be placed at different points on large and important castings in a way that will enable the City's inspector to ascertain whether all parts of the casting are uniformly and properly annealed. As three annealings (the first one and two reannealings) will be permitted, sufficient projections shall be provided for ascertaining the effect of each successive annealing.

The projections shall be such that they can be turned down or planed to specimens of standard size and shape. Any projection used for testing shall be broken off only in the presence of the City's inspector, and if the grain is found to be refined, he will stamp the piece or pieces broken off for identification.

After the inspection and tests are satisfactorily completed, all projections, fins from sink heads and runners, and annealing scale shall be removed.

Surfaces which are to be machined may be left untouched but such surfaces must be distinctly marked on the shop drawings.

The contractor shall communicate with the City's inspector before starting the work, to arrange for inspection and tests. A copy of each invoice giving numbers and weights of the several castings shipped shall be sent to the inspector.

The metal shall not be overheated or otherwise injured in the casting process.

Each casting shall have a coupon from which a cube or cylinder can be cut and finished to one square inch in section and one inch high. This coupon shall not be surrounded with a chill to make it show a higher strength than the body of the casting, but shall be uniform with the casting in every respect.

CARBON STEEL FORGINGS: Steel forgings shall conform to A.S.T.M. A235-52T, Class C-1, annealed.

Heavy shafts forged directly from ingots, shall be bottom-poured, and particular care shall be taken to prevent gas pockets and shrinkage spots in these ingots.

Wherever shafts are forged in pairs, they shall be severed before being annealed.

Each shaft forging more than three (3) inches in diameter shall have a prolongation of sufficient length from which standard sized test specimens may be obtained by means of a core-drill or rim cutter. Each shaft and each test specimen shall be marked with a designation number; complete records of all tests made shall be kept. Where shafts are forged in pairs, provision for test specimens for each shaft of such pairs shall be made.

If the test specimen from a forging annealed once, fails to meet the City's specifications, the forging may be reannealed, and if still unsatisfactory, reannealed a second time. But the same forging shall in no case be subjected to more than three (3) annealings, that is, the initial annealing and the two reannealings.

Heating and quenching of shaft forgings to secure certain desired physical qualities shall not be resorted to except by written permission from the Commissioner.

If the inspection holes are required in heavy forgings to determine their interior soundness, such holes shall preferably be bored at the forge shop. The contractor shall communicate with the City's inspector before starting the work, to arrange for inspection and tests. A copy of each shipping invoice giving the designating number and weight of each shaft forging shall be sent to the same address.

Only new metals shall be used in the composition, no scrap whatever being permitted.

THRUST BEARINGS: Bearings shall conform to A.S.T.M. B-202-60-T Grade 1, Class A.

BABBITT METAL: Babbitt metal for bearings shall be an approved anti-friction or babbitt metal of approximately the following proportions:

Tin	86 per cent
Antimony	8 per cent
Copper	6 per cent

COLD FINISHED SHAFTS: All cold finished shafts shall conform to AISI-C1018.

COUNTERWEIGHT: Counterweights shall be made from reject re-roll quality steel slabs.

PHOSPHOR BRONZE: Phosphor Bronze for bearings shall conform to A.S.T.M. B-22-44T, Class B.



## DETAILS OF DESIGN AND FABRICATION

SHAFTS: Shafts shall be made of carbon steel forgings or cold finished steel.

The shafts made of carbon steel forgings shall be thoroughly and uniformly annealed. They shall be either forged from ingots of sufficient size and under a forging pressure sufficient to produce solid forgings and then a concentric hole of a diameter as given on plans shall be bored through the entire length of each shaft; or they may be forged over a mandrel of suitable size and the holes thus obtained bored to the required diameter. The shafts thus fabricated shall be carefully machined all over and finished with true and smooth surfaces at journals and bearings. Proper allowances shall be made for fits as called for on the drawings. Shafts shall have shoulders for all gears and pinnions as shown on the drawings. The drawings do not in all cases show these shoulders, but the contractor shall provide and indicate same on the detail shop drawings. The bearing surfaces to be assembled inside of hubs of grears, etc., shall be finished, as to size and surfaces, suitable for the fit required. Exposed parts of shafts (between bearing and wearing surfaces) shall be turned true to form and size and finished so that the condition of the material at the surface is not injured and may be clearly seen and the surface is uniform to the touch. Proper fillets or tapers shall be left where the diameter changes and the ends of the shafts shall be chamfered.

Shafts shall be key-seated, fitted and keyed to their respective matching parts in the shop, and all pieces matchmarked to insure like assembly in the field.

CENTERING OF SHAFTS: All shafts shall be centered for a sixty (60) degree lathe center with a clearance hole for the lathe center point, so that the finished shaft may be readily replaced in the lathe in case of repair. Any shaft provided with an inspection hole shall have the ends specially prepared for the attachment of an approved centering device in order to facilitate the replacing of such a shaft in a lathe, if it should be found necessary.

SHAFT BEARINGS AND JOURNALS: All shaft-bearings in bearing frames, or separate journal blocks, shall be made of cast steel, lined with phosphor bronze or babbitt, as indicated for each bearing on the accompanying plans. Each bearing cap shall be planed to a light driving fit with the bearing base. Where phosphor bronze bushing are used, the bearing cap and base, assembled for shim clearance, shall be bored to accurate location and diameter. The bushing shall be cast and machined as a complete hollow cylinder and finally cut into halves with correct shim allowance.

When completely assembled the shims shall be a tight fit between the bushing halves but have 0.0065" to 0.01" clearance (according to bearing diameter), between shim and cap and base respectively, as indicated on the drawings.

Outer diameters of bushing bodies and corresponding diameters of bored seats in journal-blocks, shall have the same tolerances, corresponding with shafts of the same size.

In order to provide space for lubricant, the journal bearings shall be bored smooth and true to a diameter exceeding that of the shaft by an amount between (0.001 VD + 0.007") and (0.001 VD + 0.010"), D being equal to the diameter of the journal in inches.

The variation tolerances and lubrication allowances specified above shall be noted on the shop or working drawings of such parts.

When finally fitted and assembled the bushing halves must be tight in their seats and on the shims or liners and allow the shaft to turn freely but without unnecessary looseness.

The brass liners or shims for all bearings shall be made up of three partial thicknesses, the lowest equal to one-half the upper two each equal to one-fourth, and the three together equal to the entire gap between the two bushing halves. The three liners shall have the same outline in plan. The lower two shall be solid but the top liner shall be made up of sheet-brass laminations, (each lamination not more than one one-hundredth (0.01) inch thick, soldered together on the long edges only, the ends being left unsoldered to facilitate removal of one or more laminations. Dowel pins shall be provided to hold liners in position in their respective places, except where the holding down bolts for the caps accomplish the same purpose, or as shown on the drawings.

Except where otherwise noted lubricating grooves shall be provided in each of the halves of the bushing, meeting and crossing each other at the oil hole in the upper part and at a corresponding spot in the lower half of the bushing and extending diagonally across the bearing surface to the split between the upper and lower halves. In addition, two horizontal oil grooves shall be provided by chamfering the inside edges of each half bushing at the split, where the diagonal grooves terminate and by cutting back the inner edges of the shims or liners 1/16 inch except at the ends. In order to prevent the lubricating material from leaking out, these diagonal and horizontal grooves shall never extend the full length of the bushing, but must stop at a distance of 1/4 to 1/2 inch from the ends of the bushing. When more than one lubricating hole is used, diagonal grooves shall be provided for each hole. Solid bushings shall, as far as practicable, be treated in the same manner as split bushings.

A pipe of suitable size shall pass freely through a hole in the bearing cap and screw into the upper bushing half and have a connection at upper end for a suitably located lubricating attachment.

Where babbitt is used, it shall be thoroughly ball-pein hammered after being poured in place and shall be bored and scraped to good bearing surface for shaft, with proper diameter allowance for lubrication, and be suitably grooved. The thickness of babbitt shall not differ from the average thickness by more than plus or minus twenty (20) per cent.

The holes in the journal-block bases shall be drilled, in the shop for a light driving fit for the turned bolts and corresponding holes in the supporting frame shall be left blank unless otherwise directed by the Commissioner.

KEYS AND KEY-SEATING: The bottom of keyways in shaft shall be aprallel to shaft axis. Keyways must not extend into journal bearing of shaft. The keys must have a taper in thickness of one-eighth ( $1/8$ ) inch in one foot, and the depth of keyway at shallow end in hub shall at least equal the depth in the shaft. The keys must fill keyways tightly in width in hub and shaft. Keys must be fitted to a good bearing for their entire taper surface, both top and bottom, as shown by pressure marking when driven nearly to place.

GEARS: All gears shall be of cast steel, except pinions, which shall be of forged steel, as noted on the drawings. All gear teeth shall be accurately cut to 20 degrees involute Fellow or Nuttall stub tooth pattern except where otherwise provided for.

Pitch lines shall be accurately and plainly marked on both sides of the gears and pinions, which shall be bored true for force fits on the shafts, to which they shall be securely keyed. The total backlash of the gears shall be 0.025" plus or minus 0.005".

COUPLINGS: The flexible coupling shall be equal to Falk Corporation 120T10 tapered grid stulflex flexible coupling.

The rigid couplings shall be made of steel castings and machined as shown on the drawings.

LUBRICATION: All oils and greases for all gears, bearings, coupling, etc. must be furnished and applied per manufacturer's recommendations, and as approved by the Commissioner of Public Works. The oil and grease must be suitable for both winter and summer temperature conditions. The coupling shall be packed with grease when assembling

All parts requiring pressure lubrication, all bearings, etc. shall be provided with "Alemite Mogul Dot" fittings or approved equal, which will fit the Alemite guns used for other bridges, and be of minimum different sizes and styles, and provided with automatic pressure cups and light springs where required or where shown on the plans. The fittings must be made accessible by providing suitable pipe extensions, elbows, etc. Contractor shall furnish a diagram showing the locations to be oiled and greased, which can be used by bridge operators for lubricating the bridge.

Grease fittings must be extended by copper tubing for all bearings, etc. to convenient locations. Grease lines for bearings under deck of bridge over river area should be extended over to curb line.

Rigidly fasten all fittings where connected to tubing. Furnish caps for all fittings after installations for the purpose of keeping the fittings free from paint when painting the bridge.

This Contractor shall also furnish two (2) guns and two (2) loaders of an approved type for filling the guns.

All machined parts exposed to the weather shall receive a heavy coat of suitable grease or anti-rust compound before shipment, and if accidentally removed the damaged coating shall be carefully restored.

MACHINERY, BOLTS, NUTS AND WASHERS: All bolts shall be made of rivet steel unless otherwise specified, and shall be annealed before being machined. Cold rolled steel shall not be used for bolts in tension. Bolt heads shall be formed solid with body of bolt and be finished on bearing surface, except where shown otherwise. Turned bolts shall be true to form and size; the body shall have a light driving fit in a reamed hole, unless otherwise noted, and shall be long enough for ample bearing in the hole, thick washers being used where necessary, even though not shown on the City's drawings. The axis of the thread shall coincide with that of the bolt body; the thread shall be equal to lathe-cut and long enough for full bearing in nut, shall fit snugly and shall be chamfered at end. In general, bolts shall have square heads and two (2) hexagonal nuts proportioned to the United States standard for unfinished sizes, the thickness of the head being equal to one-half the flat diameter.

All nuts used on machinery parts shall be semi-finished and bearing surfaces shall be faced square with axis of thread. Where two nuts are used on a bolt for locking, they shall both be of standard thickness, and both shall be faced square with axis of thread on each end. Bevel washers shall be used wherever nuts or bolt heads would otherwise come against the slant surface of an I-Beam or channel flange.

Single nuts secured by spring-cotters on the exposed or outer ends of bolts shall be of the castellated form. Where a nut with a large spring-cotter is used instead of a bolt-head, the nut shall be square, of standard thickness, and round-bottom- grooved at its outer end to a total depth equal to the diameter of the spring-cotter, and the bolt shall be drilled so that the spring-cotter is at the bottom of the groove when properly assembled.

EYE BOLTS: Each casting which is bolted in place and if too heavy to be lifted by hand, shall be tapped for and provided with an eye bolt of suitable size, at some point convenient for lifting with tackle when casting is in place.

SETTING-UP MARKS: The various parts of units or groups, such as shaft couplings or bearings, before leaving the shop, shall be marked according to position and relation to facilitate re-assembling.

COLLARS: Furnish and install safety collars with set screws where shown on the drawings. Collars shall be made of solid malleable iron and as manufactured by Link Belt Co., or equal.

WIRE ROPES AND FITTINGS: Wire rope for equalizer and counterweights shall be qual to Monarch Whyte Strand F C improved plan steel grade, 6 x 19 E and 3/4" round. Breaking strength shall be 23.8 tons. Every run of wire rope shall be one length. No splices will be allowed. Furnish connections and fittings as shown on the drawings. Provide take-ups in wire rope. Tension in wire ropes for counterweights shall be equal.

SHEAVES AND DRUMS: Sheaves and drums shall be made steel castings A.S.T.M. A27-52T Grade 65-35, annealed. They shall be machined and finished as shown on the drawings.

THRUST BEARINGS: Thrust bearings shall be equal to Oilite Co. self-lubricating bearings of high oil content fabricated from metal powders. They contain approximately 20% oil by volume. They shall be equal to Oilite Bronze and conform to A.S.T.M. B-202-60-T, Grade 1, Class A. Thrust bearings shall be cut and machined from Oilite Bronze plate stock if sizes required are unavailable in stock size.

PATTERNS: All patterns including core boxes shall become the property of the City and upon completion of the work, shall be delivered in good condition to storage room at 400 W. Traser St. Patterns for castings shall be made neat, strong and durable of thoroughly seasoned, first-class pattern lumber. They shall be proportioned to suit the shrinkage of the particular metal to be cast from them and shall have ample allowance for tool finish where required. The outstanding unfinished edges of all ribs, bases, etc.



shall be rounded off to a radius of one-fourth the thickness of the ribs, bases, etc., and inside corners shall be fitted with wood or leather fillets rounded out to a radius of at least one-half the thickness of the thinnest member forming the corner.

All patterns shall be fitted with lifting and rapping plates, set flush with their surfaces. A metal plate bearing the letters "ST. PAUL - DETROIT" in sharp gothic style, at least 3/4" high shall be fitted into each pattern.

Patterns shall be stained black on surfaces unfinished on castings, red on surfaces tool finished, and yellow or clear shellac on core prints. The patterns shall be thoroughly varnished before use with first-class pattern shellac, and after final use shall be repaired, cleaned and varnished again before delivery to the City.

All patterns shall be subject to inspection and approved before castings are made from them and again on final delivery to the City.

COUNTERWEIGHTS: The Lift Span shall be counterweighted so that at all times it will be span heavy. When the hydraulic pressure is released the Lift Span through gravitational forces shall drift slowly downward overcoming all resistances.

The approximate amount of counterweight is 145 ton. The exact amount shall be determined by this contractor from computations based on approved shop details and as hereinafter specified. There shall be an additional 5 ton of adjusting plates or slabs provided with detachable eye bolt lifting devices. This contractor shall properly balance the Lift Span and make all necessary adjustments and alterations which the Commissioner may require in order to obtain the proper operation.

The material used for the counterweight shall be reject steel slabs, re-roll quality.

The slabs shall be cut, assembled and bolted together as shown on the drawings. Counterweights are required to be painted.

GUIDE WHEELS AND RAILS: Guide wheels and rails shall be installed as shown on the drawings. Guide wheels shall be made job cast steel. The guide wheels at the fixed end of the bridge shall have flanges and at the expansion end of the bridge the guide wheels shall be without flanges to permit the bridge to move longitudinally. Rails shall be made of cast steel set plumb and shimmed as required.

PAINTING: All machinery shall be painted one shop coat and two field coats same as is specified herein above for structural steel.



MACHINED SURFACES: Machine finished surfaces shall be coated as soon as practicable after being accepted, with a hot mixture of white lead and tallow or other approved coating, before removal from the shop.

ERECTION OF MACHINERY: All machinery parts, when they are unloaded at the bridge site, shall be stored in such a manner that they will be protected from dampness of ground and weather and such order that they can be readily found and inspected.

When the machinery parts are being erected, they shall be covered by a tarpaulin or otherwise while work on them is interrupted.

If the anti-rust coating on any machinery part should become removed accidentally or otherwise, thereby exposing the surface of the metal to dampness, the damaged coating shall be carefully restored.

In the erection of the machinery, great care shall be taken that the various parts are truly aligned in their proper positions, so that when entirely assembled, all machinery will operate smoothly, without binding and undue looseness of the parts.

Each shaft having three or more bearings shall have the bearings aligned horizontally and vertically, shims being provided if necessary, so that the shaft can turn freely in its bearings.

Shimming under journal - blocks shall be avoided as much as possible but wherever shims are required only one perfectly fitted shim shall be used under any one bearing block. All shafts must run freely, but without unnecessary looseness while the journal block caps are screwed down tight against their shims. All parts must have the least amount of backlash or play consistent with free operation.

To facilitate the proper alignment of the machinery, all field holes in castings will be drilled or reamed full size, and the corresponding holes in the structural steel work will be left blank, unless otherwise directed by the Commissioner.

INSPECTION DURING ERECTION OF MACHINERY: The machinery and all machinelike elements or parts, shall be assembled, erected, aligned, and adjusted at the bridge site, under the direct and continuous inspection of the City's Machinery Inspector, who must be afforded every opportunity and facility by the Contractor to satisfy himself that the work is being done in accordance with the plans and specifications.

OPERATION OF THE LIFT SPAN: This Contractor shall operate the lift span until such time as the Commissioner of Public Works shall declare the bridge open for vehicular traffic, at which time the City will take over the operation of the lift span.

POWER AND LIGHT FACILITIES: All electrical current for power and light and all temporary equipment and circuits and work required for construction purposes must be paid by the Contractor and done at the Contractor's expense. Current used to operate the bridge prior to final acceptance of the work by the City of Milwaukee, must be paid for by the Contractor.

RIVER TRAFFIC: River Traffic on the Milwaukee River shall be maintained at all times without interruption. All Federal laws governing navigable waters shall be strictly complied with. The structural steel in the two spans east of the lift span may not be erected until the lift span is erected and operable to the extent that it can be raised and kept in the raised position at which time river traffic can operate under and thru the lift span.

Therefore the First Branch Contractor will be required to schedule his work so that Piers No. 2 and 3<sup>and</sup> the operator's house are substantially completed by March 1, 1966 at which time this Second Branch Contractor shall commence the erection of the lift span. Concurrently on March 1, 1966 the Fourth Branch Contractor shall commence the installation of the 5 H.P. gas operated hydraulic lifting machine and the hydraulic cylinders and pistons so that the span can be lifted hydraulically as early in the month of April as possible and not later than May 1, 1966.

The navigational requirements will have hereby been satisfied and this contractor can proceed with the remainder of his work by coordination with the work of other contractors in such a manner as to insure completion within the time allowance for this contract.

THIRD BRANCH  
Electrical Work

(See also "General Specifications of the Department of Public Works")

FORM OF BID: This Contractor shall submit an aggregate price for the labor, material, tools, and equipment of whatever nature required for the satisfactory installation of all work included under this branch, all in accordance with the drawings, these specifications and code rulings.

GENERAL: The Contractor for this work is to refer to the "General Specifications of the Department of Public Works" as he will be held responsible for all requirements made therein. He shall visit the site and consult all of drawings and specifications so as to be familiar with this work and that of the other Contractors.

The Contractor shall furnish and install, complete in every detail and every respect, whether specifically specified or not, all electrical equipment, wiring and electrical work for the bridge, commencing at a WEPCO manhole located west of the west abutment. Contractors work shall include complete installation of: feeders from WEPCO manhole over to bridge house area, meter, current cabinet, signals, electrical equipment, controls, switchboards, control panels, cabinets boxes, navigation lighting and control system, a complete lighting system with reflectors, lamps, conduit, wiring for all equipment, door bell, switches, cabinets, dials, indicating instruments, limit switches, transformers, clock, telephone and fire alarm conduits, etc. in accordance with the plans and these specifications as required to make the installation complete including emergency power generator and all field connections to the hydraulic machinery and controls as furnished by the Hydraulic Operating Equipment Contractor.

SPECIAL CONDITIONS: Traffic gates will not be installed at this time. However, the bridge control system shall be installed complete with gate controls interlocked as if they were to be installed. Provide conduit, wiring terminals, controls, etc. for future gate operation as specified hereinafter and as shown on the drawings.

It is intended that these specifications shall provide for a complete electrical installation, essentially as shown on accompanying drawings, or as described herein, or as may be required, including the work of cleaning, adjusting the equipment to suit the operating conditions, and furnishing all operating instructions in a manner satisfactory to the Commissioner of Public Works.

All of the electrical controls as specified herein shall have been built for at least two other bridges and each shall have been in operation for at least one year. The Contractor shall furnish the location of such installations as comply with these conditions.

The Contractor shall obtain from the Commissioner of Public Works, in the field, the exact location of all apparatus and equipment not definitely located on the drawings in dimensioned form.

SCOPE OF WORK: The Electrical Contractor's work shall include the furnishing of all labor and material for the following:

1. Furnish and install the one-station control desk in the operator's house and wire complete for operation of the bridge.
2. Furnish and install the control panelboards, enclosures, all electrical equipment and appurtenances.
3. Transformer for control and lighting.
4. Furnish and install all lighting fixtures, convenience outlets, switches, pier lights and bridge lights including those in the operator's house, clock, door bell, etc.
5. Furnish and install all conduit, flexible cable and wiring complete for the entire bridge, together with all necessary junction boxes and hangers or supports as required.
6. Furnish and install the necessary limit switches together with their supports and operating devices.
7. Signal lights, flashers, and conduit and wiring for future traffic gates.
8. Standby (Emergency) Electric Generator.
9. Sump pumps.
10. Service entrance equipment.
11. Conduit for telephone.
12. Heating cable for sewer and water lines. connections
13. Furnish a complete wiring diagram of all power and control

EQUIPMENT INSTALLED BY OTHERS AND WIRED UP BY BRANCH TWO CONTRACTOR:

1. All wiring for heating unit, including thermostat, controls, etc.
2. Sewage ejector.
3. Main hydraulic power unit and emergency hydraulic power unit.

WORK BY OTHERS:

1. Street lighting.

2. First Branch Contractor shall place all sleeves for openings in walls or floors. Number and size of sleeves to be verified by Electrical Contractor, who shall also furnish them.
3. First Branch Contractor shall grout or caulk all openings around conduits, ducts, etc., passing through concrete walls. or floors.

**GARANTEE:** The Contractor shall guarantee to replace or repair promptly at his own expense, as directed by the Commissioner of Public Works or his agent, all workmanship or materials in which defects may develop within one (1) year from the date of final acceptance of his work. This guarantee includes all damage done by the operator due to faulty equipment, poor installation or poor construction.

**PATENTS:** The Contractor shall indemnify the City of Milwaukee against all losses, claims, actions or judgments brought or received against the City of Milwaukee due to violation by the Contractor of letters, patent, patent rights, or infringements thereof, or by reason of the use of machine or manufacture of composition of materials in violation of patent or patent rights or infringement thereof.

**ADJUSTMENT AND OPERATION:** The contractor shall adjust the existing devices, and do everything necessary to suit requirements and to assure the correct operation of the bridge with the new control desk. This shall include the lubrication of all devices, and proper alignment of all shafts and bearings.

The contractor shall instruct the City of Milwaukee employees assigned to the bridge in all matters of maintenance adjustment and operation.

After all parts function properly and have received their final adjustment and approval, any part equipped with a set screw shall have the same locked into their respective shafts such that they will be safely locked into place.

**CODE RULES:** All material and labor for the installations as specified herein shall comply with the latest rulings, regulations, laws, etc. of the following:

National Electrical Code  
Statutes of the State of Wisconsin  
Ordinances of the City of Milwaukee  
A.I.E.E. Standardization Rules  
Federal Navigation Regulations  
Wisconsin Electric Power Co.



The Contractor shall secure all necessary certificates for all work installed by him, pay all fees and charges connected therewith, and deliver same to the Commissioner of Public Works.

Before submitting his bid the Contractor should familiarize himself with the rules of all boards or departments having jurisdiction. If any material or work be installed or specified contrary to such rules, same shall be altered to meet the regulations without any extra cost to the City of Milwaukee.

DRAWINGS: Furnish, as early as possible after the signing of the contract, in quadruplicate, the following drawings, etc. of the equipment the contractor proposes to furnish, together with engineering data, which must be approved before any work is done or equipment ordered, namely, Standby electric generator, control panel, switchboard, cabinets, boxes, control desk, light fixtures, limiting devices, navigation lighting units, clocks, reflectors, warning signals, pumps, complete wiring diagram of controls for both light and power, and such other drawings as may be requested.

The wires of the wiring diagram shall be systematically numbered so as to tie up the various drawings and also the numbers on the tags on the boards so that both the installation and the location of faults can be expeditiously administered. A legend or equivalent shall be submitted on the drawings to indicate the various pieces of electrical apparatus. Furnish a line diagram of all the electrical connections which summarize all the detail drawings, which detail drawings shall be as follows:

Main Panel wiring diagram  
Control Desk " "  
Connection for Accessories  
Limit Switches  
Gate Motors  
Standby Electric Generator

The contractor shall furnish ink tracings and four (4) linen sets of blueprints of the wiring diagrams after the work is completed, and one complete set of blueprints of the wiring diagrams, as installed, mounted on aluminum sheets 1/16" thick. One complete set of these wiring diagrams shall be kept in the control room on west side of the bridge.

APPROVALS: Wherever the words "or equal", "or approved equal", or similar terms are used, it shall mean approval by the Commissioner of Public Works or his agent. All drawings, bulletins and data necessary for an approval shall be submitted in quadruplicate to the Superintendent of the Bureau of Bridges and Public Buildings. Such approval shall apply to general design only and



shall in no way relieve the contractor from the responsibility for the proper operation, suitability or safety of the equipment he furnishes and installs.

All apparatus installed shall conform to space conditions, so as to use the structural work indicated on the plans for supporting all apparatus. Changes in the details required to accommodate the work of this contract shall be anticipated by this Contractor and shall be in all ways satisfactory to the Commissioner of Public Works in the field, subject to his approval, and done at no additional expense to the City of Milwaukee.

PROTECTIVE COVERING: The control desk and such other pieces of equipment, as deemed necessary by the Commissioner of Public Works or his agent, shall be completely covered at all times after delivery with a dustproof, non-porous fabric until completion of the work.

REPAIRS: The contractor shall repair all damage that he or any of his employees or subcontractors may do to any of the existing parts of the bridge.

All repairs shall be done by skilled mechanics and to match existing construction; they must meet with the approval of the Commissioner of Public Works or his agent.

CLEANING UP: All rubbish, cartons surplus electrical materials caused through this work must be removed from the premises.

TESTING: This contractor shall test all circuits and equipment he has furnished and leave same in satisfactory operating condition properly lubricated where required.

This contractor shall arrange for all electrical inspections, furnish all affidavits, etc.

City of Milwaukee will not accept the job until approved by the City Electrical Inspector and electrical service is permanently connected and properly operating.

Heat tests, potential tests and temperature tests shall be made in accordance with the Standardization Rules of the American Institute of Electrical Engineers. Tests shall be made showing the brake horse power and torque in accordance with these specifications. Characteristic curves showing the results of such tests shall be furnished in quadruplicate to the Commissioner of Public Works whose approval must be obtained before shipment is made. Certified copies of factory tests of all electrically operated devices shall be furnished by the contractor.

ELECTRICAL SERVICE: WEPCO shall install 240 volt, 3 phase, 60 cycle feeders into a manhole west of the west abutment.

This contractor shall extend the service from this manhole over to the bridge house as shown on the drawings.

For this service use 3 - 250,000 circular mill cables in 3" conduit.

This Contractor shall furnish and install one Cutler-Hammer Cat. #4105-H344, NEMA I, or equal safety entrance switch, 240 volt, three wire, solid neutral, 200 amperes.

For lighting service line furnish and install one Cutler-Hammer Cat. #4131-H203, NEMA I, or equal fusible safety switch, 240 volt, 2-wire, 70A fuses, 100 amperes.

In front of the service entrance safety switch furnish and install service entrance box and meter and other necessary electrical equipment as required by the Wisconsin Electric Power Co.

All boxes, switches, etc. shall be fastened firmly to the wall using cinch anchors or other fasteners approved by the City.

All conduits, pull boxes, etc., in regard to any electrical apparatus lighting circuits, telephone, etc., shall be furnished and installed by this contractor. Wiring for the telephone shall be done by others.

Street lighting forms no part of this contract.

CURRENT: The current for the main motor, gate motors, sump pump motor, emergency pump motor and emergency electric generator shall be 240 volt, 3 phase, 60 cycle.

The lighting systems, all signal systems and the like, shall be single phase, 120/240 volt, two wire and shall consist of one (10) KW transformer on the west side of the bridge with suitable switches and proper circuit protectors on the primary side.

The lighting circuits shall be taken from the live side of the 3 phase disconnect switch so that the 3 phase power may be off completely with all of the lights for general illumination on.

LOCATION OF CONTROLS: It is intended that all motors, controls, lights, etc., shall be as shown. All controls and equipment, shall be furnished for both sides. The switchboards, controls, etc., and its apparatus shall be installed in the existing Electrical Control room in the Bridge House.

Except as shown, these controls shall be set in a desk type panel resting on the floor of the operator's house.

CHASES, CUTTING, BURNING AND WELDING: At no time will this contractor be permitted to cut or burn holes, slots, etc., in the existing steel structure to place his conduits, equipment, etc. except as shown.

Hangers, brackets, boxes, etc., necessary for the installation of conduits, switches, or other equipment shall be welded to the existing steel structure or supported from the existing structure with fasteners. No welding shall be done or fastening devices employed without prior approval of the Commissioner of Public Works or his agent.

PAINTING: All electrical equipment in operator's room, equipment at switchboard, etc., must be cleaned, painted, varnished, polished or refinished as may be directed, so as to have a finished surface after installation.

Contractor shall touch up with red lead all scratches, welds, burrs, etc.

CONDUIT BOXES: Outlet or junction boxes shall be sherardized or galvanized.

Outlet boxes and junction boxes on the bridge or where exposed to the weather directly or indirectly must be of the galvanized malleable iron type especially suited for the purposes intended such as galvanized condulets with threaded pipe openings with rubber gaskets so as to be weatherproof.

Where boxes support fixtures they shall be equipped with no bolt fixture studs and be securely anchored to the structure with approved fastening devices for the type of construction involved. No enameled or painted boxes shall be used. No sectional boxes shall be used.

SWITCHES AND OUTLETS: Wall switches for the operator's house shall be 10 ampere, 125 volt, fully enclosed Bakelite or equivalent composition cases, toggle type.

Single Pole Switches - Equal to Bryant #4961  
3 Way Switches - Equal to Bryant #4963

All switches except those in the house, shall be vapor-tight and weatherproof tumbler switches equal to Crouse-Hinds, DS-128.

Switches in the house shall be installed flush, with required plates wherever possible. Switches mounted on existing walls or columns shall be equipped with raised type metal plates to fit switch box employed.

Where switches are shown in gangs this contractor shall provide gang switch plates of proper size as required.

Convenience outlets in the operator's house shall be duplex, 15 ampere brown Bakelite similar and equal to Bryant #9260. All other convenience outlets shall be 15 ampere, 125 volt, with threaded cap on cover similar or equal to Crouse-Hinds #Ds-96.

CONDUIT: All conduit shall be rigid galvanized steel and shall be G.E. White, or equal, without enamel finish. The galvanizing shall not crack or flake when the conduit is bent at right angles on a radius equal to 8 times its inside diameter. The galvanizing shall stand the standard T & T copper sulphate solution test for hot dip galvanizing. Attention is especially called to the fact that couplings, bends, boxes, and elbows are included under the term "conduit" as defined above; the requirements as to material shall also apply to these parts of the conduit system.

All rods, supports, screws, etc. used in the installation of conduits, boxes, cabinets, etc. shall be galvanized when used on the bridge or when open to outside weather conditions.

Conduit at all motors shall be American Brass "Sealtite" flexible conduit with standard liquid tight connectors or approved equal.

Conduit around machinery shall be neatly run where necessarily exposed and connected with condulets. The conduit shall run along the equipment, etc. and not out in the open. Turns shall be made with condulets, unless the conduit hugs a curved surface, to where the conduit may be bent.

Conduit on the lead (moving parts) must be installed with extraordinary precaution against vibration or becoming loose due to vibration by the free usage of position lock washers, two nuts, upsetting threads, etc.

The contractor will be required to choose his own routes of conduit with the approval of the Commissioner of Public Works in the field, so as to avoid all obstacles or obstructions. Conduit must be run in place, made secure and tight, and wire pulled after completing the conduit work. No safety or fish wires will be permitted in conduit while same is being laid. Conduits shall be so installed that the required conductors may be drawn in without injury or excessive strain.

There shall be at least one inch (1") clearance between conduits and boxes. Wherever conduit is threaded into boxes or fittings the threaded surfaces shall be painted with white lead, when fitting up, so that there will be no unprotected surfaces exposed.

Cast iron, except malleable cast iron, shall not be used in the construction or for the small electrical parts which are located on the movable parts of the bridge.

WIRE AND CABLE: All wire and cable, in conduit, shall be Type TW when used in conduit, covered, 600 volt. All wire shall be thoroughly tinned, soft drawn 98 per cent conductivity copper.

Minimum size of wire shall be #12 except for control circuits where #14 wire may be used. Wire in flexible conduit shall be #12 stranded. All other wiring shall be sized as shown on the drawing or specified by the codes.

The neutral wire of all branch circuits shall have a white braid and all connections to single pole switches shall be so made that the operation of the switch opens the outside leg.

INSTALLATION OF WIRE AND CABLES: All wiring in the top floor of the bridge house shall be concealed with flush outlets. In general, wiring for the bridge, etc. should be run in neatly arranged exposed conduit. Exposed conduit construction must be of such construction and workmanship as will make the wiring free from water by the use of suitable drainage arrangements, drain tees and steam tight threaded pipe connections in malleable iron fittings.

The navigation lights, both bridge and channel lights shall be switched separately from the control desk and shall constitute independent circuits. There shall be an independent circuit for each roadway gate motor, warning bell, traffic stop signals, roadway gate lights, and for each group of lamps, with overload protection for each group. No common grounded return circuit will be permitted.

From the control cabinets, sitting on the floor at Elev. + 4.00, install a wiring duct for all wires and cables running to the control desk. All wires shall be tagged.

Duct shall be as manufactured by Square D Co. Provide elbows, connectors, etc. as required. Ducts to be fastened to wall and ceilings with Rawl plug type fasteners. Duct shall pass through concrete floors. This contractor shall verify size and location of opening to Concrete Contractor who shall form opening in the floors. Grout space around duct after duct is in place.



CONTROL WIRES: This contractor shall furnish and install all the control wiring in the duct or conduits.

All stranded conductors shall be furnished with finished forged tube copper connecting lugs, drilled or reamed the full diameter of the bare conductor.

All joints shall be mechanically strong before soldering and must be carefully soldered without the use of acid, covered with a covering of rubber compound tape to a thickness equal to that of the insulation and then with a covering of adhesive tape in two layers. The braid shall be cut back so that the insulation tape will bond with the insulation of the wire or cable. Paint all joints in all power circuits and all lighting circuits in exposed conduits with weatherproof insulating varnish.

Wires, in general, shall be properly bunched, served with tape, the end of tape firmly tied in place to prevent loosening and finished with insulating varnish.

On the bridge, or where subject to vibration, wires and cables at horizontal entrances to boxes shall be supported at the lower edge with fiber sleeves firmly attached to the wire.

At all terminals and in junction boxes, etc., wires are to be permanently tagged with fibre, or equal, identification tags which shall bear the same identification marks as appear on the wiring diagram. The switchboard shall have metal tags mounted at the connectors, or plates mounted on the board.

FLEXIBLE CABLES: P.W.C. Multi-conductor flexible control cable, rated 600 volt insulation. 30, #12 A.W.G. conductors (65 strands of #30 copper wire per conductor) insulated with a high dielectric strength of polyvinyl chloride, color coded to make circuits easily traceable and cabled for maximum flexibility, with a hard service jacket around outside, of polyvinyl chloride, which will not support combustion, is abrasion and impact resistant, and will not lose its resiliency or harden and crack when subjected to extremes of outside temperatures.

CABINETS: Circuits, such as the lighting circuits, etc., shall be fed, in general, from flush type cabinets equipped with De-ion circuit protectors. Cabinets shall have wiring gutters. Provide at least one spare branch for every five circuits or fraction thereof. For lighting purposes, and other 110 volt circuits, the wattage per circuit shall not, in general, exceed 1200 watts, approximately. Heavy gauge welded steel construction.

The lighting and control distribution cabinet and the power distribution cabinet shall be installed where shown on the drawings.



1. Lighting and control distribution cabinet Square "D" Q020M 100 amp.
2. Power Distribution Cabinet Square "D" Q020M125, 125 amp.

All pull boxes, cabinets for the termination of the wires, cables, etc. shall be made according to the Wisconsin State Electrical Code (refer to orders 1307.01, 1307.02 and 1307-03). They shall be made weatherproof with suitable drainage holes and gaskets under all covers.

On all steel cabinets and pull boxes use a corrosion resistant finish consisting of medium light gray enamel over clear varnish with phosphats treatment and zinc chromate primer.

TERMINAL BOXES: NEMA #12 construction, waterproof, all welded sides and back. Heavy gauge steel with gasketed hinged doors and padlock type hasp and external clamps, zinc chromate primer and varnish under light gray enamel for a corrosion resistant finish outside and white enamel inside, as manufactured by the Geo. F. Rohn Electric Co. 2422 W. Clybourn Street, Cat. B-22.

LIGHTING RECEPTACLES: The drawings show the location of all lighting and convenience outlets, switches for same, etc. for general lighting service, all of which are to be installed completely with lamps, reflectors, etc., for the bridge house, machinery spaces, stairways, platforms, etc. The system shall be installed to suit the electric lighting service herein described.

Outlets in the ceiling of the machinery rooms, platforms etc., shall be placed between beams and not on the underside of beams.

#### Type A

- Bascule bridge lamp. Cast iron base, fitted with 8" - 180° red and green Fresnel lenses. Totally weatherproof, and complete with retriever chain and access opening for lamp renewal. These lamps are to be controlled from the operator's desk and the limit switches on the operating machinery shall change the color scheme from red (down) to green (up) Western R.R. Supply of Wallace & Tiernan Cat. #710-170, Drawing 18150-1

#### Type B

- Standard pier lamp. Cast iron base, fitted with 8" 180° red Fresnel lens, totally waterproof, complete with flange for mounting on pilings. Western Railroad Supply bulletin #144, Fig. #1 page 3, or approved equal. These lights shall be controlled from the desk. Wallace & Tiernan Cat. #710-170, Drawing 8912-1

Type C

- Surface mounted fluorescent fixture, 2 - 40 watt rapid start 48" long warm white lamps, wrap around lens, EPS248R4 Northern Light Co.

Type D

- 100 watt, wall mounted, explosion proof and dust tight fixtures. Type "ELB" Bracket fixture Gray Bar Cat. #105 p. 1063, R & S 4541

Type E

- 100 watt standard RLM dome reflectors 12" dia. porcelain enameled. Benjamin #7641 SHB-1/2 as listed on page #1051 of Graybar Cat. #105
- Suspended with Universal type aligners equal to Crouse-Hinds or Appleton, type "GS" for mounting on cast box.
- Fixture stems 1/2" galvanized pipe.

Type F

- 150 watts, ceiling mounted, prismatic glass refractor bowl in steel housing with separate ceiling plate which holds the medium base socket and metal reflector. Pearl gray finish. Holophane No. C-824 or equal.

Type G

- 100 watt, wall mounted white porcelain fixture with convenience outlet. Graybar Cat. #AL-2382 or equal.

Type H

- 100 watt, ceiling mounted, explosion proof and dust tight fixture, type ELP, Graybar Cat. #105, p. 1063, R & S 4501.

Type I

- Shall be equal to Crouse-Hinds type TSV-113DT, or Eagle Cat. #S-13J, Graybar Cat. #105, p. 1007, 3 section traffic signals. Each signal shall be one-way fixed type unit for mounting on street light post. Use Crouse-Hinds pole clamps for mounting light on poles. Pole clamps made of aluminum.

Housing of each section shall be of die or sand cast aluminum, weatherproof, strong and have a smooth and neat appearance. The sections shall be made so that they can be securely bolted together. The finish shall be black baked enamel.

The optical units are to have an 8" diameter reflector of such design as to effectively combat "Internal Phantom" without impairing the optical efficiency and to be heavy precision spun Alzak or of high quality clear glass with the silvering protected by a heavy coating of backing material. The reflector must be held securely against a lens gasket and be dust tight. The optical unit is to be designed for use with a 60 watt 115 volt high grade traffic signal bulb.

The top and bottom lens are to be red and equal to Crouse-Hinds type T combination lens designed to meet the candlepower distribution requirements of the Specifications of the Institute of Traffic Engineers. The center lens shall be red with the word "STOP" lettered on it and shall be of the prismatic diffusing type and equal to the top and bottom lens. All of the lens are to have a smooth outside surface to prevent the accumulation of snow and ice.

Each section shall have a metal sun visor, open at the bottom, approximately 7" long and a downward tilt of about 8°.

The complete signal must have a neat and attractive appearance and be of a rigid construction that will withstand rough usage. All parts are to be made sufficiently accurate to permit complete interchangeability.

LAMPS: This contractor shall furnish and install lamps in all sockets to suit the voltage of the transformer. They shall be the standard line for the fixture specified.

LIGHTING TRANSFORMER: Furnish and install one 10 KW dry type transformer as manufactured by the Hevi-Duty Electric Co. Type S-1B10, Class B or approved equal; 240 volt primary and 240 - 120 volt secondary, 3 wires.

Underwriters Laboratories approval.

Designed in accordance with A.I.E.E. standards not to exceed 55° temperature rise at full load.

FLASHERS: This Contractor will furnish and install flashers, one for each side with all the necessary control circuits from the desks through the contactor, etc. for these flasher circuits and all wires necessary to make a complete installation. Provide contacts for future gate lights as these lights would be connected to the flashers.

The flashers are to be equal to Crouse-Hinds #TSS-18 or Eagle #HT722A622 with a radio interference suppressor and a fuse block. (Cat. Section #602, page 6). They are to have a general purpose enclosure for indoor mounting, a motor type drive able to

control 2-circuits carrying an incandescent lamp load of at least 10 amperes each. The speed of the flash is to be approximately 40 minute with an adjustment for variation of plus or minus 10 flashes.

WARNING BELLS: Western Railroad Supply Co. type #222.

- 12" Steel gong.
- A. C. motorized valve.
- Operation 120 V. A. C. motor driven.
- 200 strokes per minute.
- With mounting adaptor for mounting on traffic signal bracket.

CIRCUIT PROTECTION: All feeders and main circuits required for power, light, signals, etc. shall be protected as specified, and as required by code requirements, by circuit breakers, or equivalent fuseless protection, which have an inverse-time-limit feature to prevent tripping on momentary overloads, but provide instantaneous tripping on heavy short circuits. It shall be impossible to hold the handle closed against short circuits. They shall, in general, be made tamper-proof. Local control desk circuits for closing contactors, breakers, etc. may be fused.

CONTROL: The control shall consist of a main control panelboard located on the pier level of the house and one main control desk to be located on the third floor of the operator's house. This contractor shall also furnish the limit switches, position indicating devices, etc. especially designed or applicable to bridge operation.

MAIN CONTROL ENCLOSURE:

- Constructed of metal, NEMA #1A cabinet, totally enclosed, front access, with hinged doors and three point latches.
- Overall height not to exceed 72", width sufficient to receive the required control boards without crowding and lengths as shown on drawing.
- Conduit entrances provided at top as shown. (All conduit connections to be made such that no water or condensation can enter the enclosure at the conduit entrances)
- Factory paint before assembly of controls, finish ASA No. 49 enamel baked on.

CONTROL EQUIPMENT IN MAIN CONTROL PANEL BOARD: Devices required for operation of the bridge shall be mounted without crowding and with ample creepage distance between all current carrying parts. Each device shall be identified by an engraved name plate in white letters with black background.

Circuit breakers shall be of such type as is necessary to carry the rated current of the circuit in which they are connected as defined in regulations of the National Board of Fire Underwriters, but in no case less than 60 ampere frame size.

The control panel board shall contain all the contactors, relays and switches necessary for the operation of the bridge and to provide all interlock circuits. These devices shall be completely wired with all necessary terminals for external power circuit connections. All control or equivalent size wires that are to be connected to other devices apart from the panel board shall be connected to terminal boards with the terminal numbered to agree with the wiring diagram. No wire shall be smaller than #12 to be used in connecting the various control devices to the panel board. All components, wiring, etc. shall be rated in accordance with NEMA standards for 600 volts maximum.

The control panelboard shall include the following principal items of control:

<u>Item</u>	<u>No. Reg.</u>	<u>Description</u>
1	1	3 pole, single throw, dead front, 600 v., 200 a., 60 cycle circuit breaker. Square "D", Westinghouse or equal, with adjustable magnetic trip and pressure terminals; molded bakelite case.
2	1	3 pole, size 1 contactor for interlocking of the gate motor circuit
3	as req.	Terminal blocks for control circuits rated 30 A, 600 v., with screw type terminals and marking strips.
4	1	Undervoltage relay.
5	1	Phase failure relay.

CONTROL DESK: Furnish and install the main control desk on the third floor of operators house (control room). Overall sizes 30" x 60" top 36" high at front sloping up to 42" high at rear.

All welded sheet metal construction with well rounded and ground corners to provide a smooth surface throughout.

Angle iron frame inside.

Sheet metal sides and back welded on angle frame.

Provide hinged doors at front and sides with concealed hinges and three point latches operated by "auto"-type, chromium plated handles, keyed alike.

Zinc chromate primer with stiple finish coat.

Provide openings for mounting control instruments on "top" of desk and name plates and instruction plates.

Instruction plates and name plates of brass with brush nickel finish, engraved and filled with black enamel.

The following instruments will be assembled to desk at factory complete with all wiring to terminal blocks inside desk; and tested for dequence grounds, and operating voltage in accordance with NEMA standards of control.

<u>Item</u>	<u>No. req.</u>	<u>Description</u>
1	2	Control switches for east and west side gate motors marked "up" and "down"
2	1	Single stroke bell within the desk for nearly open or nearly closed position of the bridge span.
3	1	Span position indicator with illuminator dial. (flush mounted type with illuminated line and letters to show position of bridge span)
4	1 each	Ammeter and voltmeter and line voltage switch.
5	as shown	Indicating lights, Cutler-Hammer Pretest #10250T with lamp and lens of designated color.
6	1	Cutler-Hammer type "O" Spring centering, mill duty, master switch
7	2	Tumbler switches sealed to by-pass gates and main power. 522-001



8	2	Snap switches for pier and navigation lights.
9	1	Desk lamp
10	1	Foot operated switch for operation of span (lift or lower) in nearly open and nearly closed position.

LIMIT SWITCHES: Furnish, install, and completely wire 4 Cutler-Hammer Type "F" double pole, Rotary lever type operated in watertight "NEMA" #4 case with 2 normally open and 2 normally closed snap acting spring return contacts; rated 15 amps. at 110 volts continuous duty for clockwise and counter clockwise operation.

Limit switches to be mounted on angle iron frame and wired to operate as shown.

Cams shall be furnished and installed by this contractor with their mounting devices as shown on drawing. Responsibility for adjustment of cams will be this contractors who will set and finally adjust his equipment to perform the functions imposed by the hydraulic equipment, as requested by the hydraulic equipment contractor.

The limit switches are shown on schematic diagram and shall provide the control for the following functions:

1. Stop the span at the fully open position.
2. Stop the span at the "nearly open" position and require the return of the master switch to the "off" position before span can be operated between "nearly open" and "fully open" positions at slow speed by means of the master controller and foot switch.
3. Stop the bridge at the "nearly closed" position and require the return of the master switch to the "off" position before span can be operated between "nearly closed" and "fully closed" positions at slow speed by means of the master controller, foot switch and pressure switch on hydraulic equipment controller.
4. Operate fully open indicating lamp.
5. Operate nearly open indicating lamp.
6. Operate nearly closed indicating lamp and warning bell.
7. Change navigation lights from red to green upon proper position of opening.
8. Change navigation lights from green to red upon closing.

INTERLOCK SYSTEMS: The complete electrical interlocking system shall provide as listed above and described below for the protection of street traffic and the bridge operating machinery such as will absolutely limit the sequence of operation of the various motors except as provided under emergency service.

1. Traffic flashers and warning bells and gate circuit are energized together in first (on) position and provision is made on switch to connect gates; the second position (bell off) deenergizes the bell with traffic flashers still energized. In this position it is now possible to operate the hydraulic machinery by means of the master switch. The master switch enables the operator to stop the span at any point in its upward travel, and lower it without reaching the upper limits of its travel.

The control of the span is interlocked with the flashing stop lights and bell and traffic gates so as to prevent the raising or lowering of the span without these being continuously energized and the gates down whether operating on main power or emergency power.

EMERGENCY SWITCHES: Provide sealed emergency switches on the control desk by means of which it will be possible to free the operation from the interlocking features in case of emergency. These switches are to plainly indicate their individual purpose, and are to be connected to accomplish the following results

1. To release interlock between gate motors and control switch so as to raise the span in case of damage to gate mechanism or in the total absence of gates.
2. To release emergency pump motor from emergency generator so that it operates on main power in case of failure of main power unit or motor.

TELEPHONE: Locate telephone outlet in operator's house as indicated on the drawings. Install a 1½" conduit system with pull-in wires outlets and necessary pull boxes for a public telephone in the control room (3rd floor).

Install one outlet box, about 6" x 10" x 4" deep, for a bell above sidewalk door on the outside of building, and similar outlets at the center of each pier near hoists. These outlet boxes are to receive a bell.

Run  $1\frac{1}{2}$ " conduit and fish wire from Telephone Company's splicing chamber and in accordance with their requirements to junction box (6 x 6 x 3" deep) located on wall of utility room as shown on sheet #47.

Run  $3/4$ " conduit from pull box to telephone bell outlet boxes as follows:

1. One in control room where indicated.
2. One above entrance door at sidewalk level (size 6" x 10" x 4" deep) for bell where indicated.
3. One on concrete beam at about elev. +11.5 at piers #2 and #3 at center line of bridge (Size 6" x 10" x 4" deep) for bells.

Install a switch outlet just inside the sidewalk door connected with conduit to telephone box in control room and bell outlet boxes at door and at centerline of bridge piers #2 and #3.

Others will furnish and install the telephone bells and telephone wire. The wires for the bell at the centerline of Pier #3 shall run through flexible cable and terminal boxes.

HEATING CABLE FOR SEWER AND WATER LINES ON BRIDGE:

- General Electric Silicone-rubber heating cable, or approved equal.
- Nichrome therm wire #19 AWG, 10 watt per foot rated.
- To cover entire lengths of sanitary sewer and water pipes outside of bridge house as noted on Plumbing drawings.
- To be thermostatically controlled to operate when Pipe temperatures fall below 40° F.
- To operate from 230 volt, A.C., from 3 phase distribution panel.
- Electrical contractor to furnish and install all materials, thermostats, capillary sensing tubes, junction boxes, conduit, etc. as required for a complete and ready to operate pipe heating system, before insulation is installed on any exposed piping.

SUMP PUMPS: Furnish, install, pipe and wire two sump pumps complete with all accessories as indicated on the drawings to suit the distance between the bottom of the sump and the pump motor equipment at the pier level elev. + 4.00. This shall include all support brackets as shown piping, sleeves, anchors, hangers, etc. for a complete and ready to operate installation.

- Pump: Yeomans heavy duty Series 3100 with bronze impeller high carbon piston steel shaft, wrought iron, suspension pipe, and discharge pipe, 20" dia. steel pump plate, motor and manual starter.
- Capacity: 75 g.p.m. minimum against a 22" head
- Pump Casing: Heavy close ground cast iron streamlined to flow and rigidly attached to suspension and discharge pipes.
- Coupling: Flexible, statically balanced
- Thrust bearing: grease lubricated self-aligning ball bearing in cast iron housing.
- Guide bearings: at approximately 4'-0" centers, renewable sleeve, grease lubricated.
- Motor: 1½ H.P., 3 phase, 240 volt, 60 cycle totally enclosed, waterproof, NEMA Frame 1, vertical type with ball bearings and mounted on heavy cast iron supports. Westinghouse, G. E. or approved equal
- Starter: Manual, push button energized in weatherproof box.

Electric Clock: G. E. Cat. #1H1608 8" dia. - Brown, plastic case black numerals and hands and red sweep second hand.

Door Bell: Furnish and install door bell signal complete with wiring system in conduit. Solid brass, chrome plated push button, with transformer, and three 3" bells one located inside the house and one at each machinery platform.

- Transformer: Edwards #874
- Bells: Edwards #551

CLEANING UP: All rubbish, cartons, surplus electrical materials caused through this branch of the work must be removed from the premises.

STANDBY ELECTRIC GENERATOR  
Included in Third Branch

SCOPE OF WORK: This Contractor shall furnish all the labor, materials, tools, and equipment of whatever nature required for the satisfactory installation of the standby electric generating plant all in accordance with these drawings, specifications and code rulings.

More specifically this Contractor shall furnish and install the following:

1. Electric generating plant
2. Automatic line transfer control
3. Accessories

WORK BY OTHERS:

1. Plumbing Contractor shall install gas piping over to unit and connect ready for operation.

ELECTRIC GENERATING UNIT

GENERAL: The standby electric generating unit shall include an Onan ISJC-SDR series electric plant or "approved equal" rated at 15KW, single-phase unity power factor, three-phase 0.8 power factor, voltage 120/240, 60 cycle.

This set shall be completely built, tested and shipped by a manufacturer who has regularly engaged in the production of such equipment and who has parts and service facilities available. The performance of the electric plant shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation.

ENGINE: The engine shall be natural gas powered, 4 cycle, 4-cylinder with pressure air cooling. It shall have a total piston displacement of no less than 120-cubic inches and develop no less than 30.9-horsepower at its operating speed of 1800 rpm.

A hot air discharge duct adapter shall be provided and a connecting duct used to allow all heated air and gasses to be discharged out from near the control room through an opening in the east wall of Pier #2.

The engine shall be of cast alloy iron construction with cast aluminum alloy heads. Valves shall be overhead and free to rotate in aluminum bronze guides. Intake valves shall be alloy steel with replaceable inserts. Exhaust valves shall be Stellite faced with replaceable Stellite exhaust seat inserts.

The crankshaft shall be ductile iron. The connecting rods shall be steel forging with replaceable inserts. There will be full pressure lubrication to the main and connecting rod bearings.

The engine shall be equipped with adjustable cam gear driven governor; horizontal natural gas carburetor with replaceable dry element air cleaner; automatic electric choke, solenoid gas valve and primary fuel regulator ASCO, full flow replaceable oil filter with by pass; oil pressure gauge and 12-volt battery ignition with radio suppression.

ALTERNATOR: The alternator shall be a 4-pole, revolving field type with static exciter and magnetic amplifier regulator. It shall be directly connected to the engine and driven through a rigid coupling to insure permanent alignment. Frequency regulation: (Droop governor) 3 cycles (5%) maximum no load to full load. Recovers to stable operation, in less than 2 seconds, on application or removal of rated load in one step.. Voltage regulation: Plus or minus 3%. Voltage dip or overshoot is less than 12% with recovery to stable operation, in less than 2 seconds, on application or removal of rated load in one step. Voltage wave form deviation factor is less than 0.08 at any load and any power factor within the unit rating.

The alternator shall have an overload capacity of 200% of rated KVA at 0.4-p.f. during transient loads such as motor starting. Temperature rise shall be 50°C as defined by NEMA MG1-11.08. It shall have radio interference reduction which exceeds requirements for most civilian and commercial applications.

INSTRUMENTS: An instrument panel mounted on top of the alternator shall contain the battery two-step automatic charge-rate regulator, charge-rate ammeter, start and stop switch for manual operation and terminals for connection to the automatic line transfer control panel.

ELECTRIC PLANT MOUNTING: The plant shall be mounted on shock or anti-vibration mounts to a raised steel or concrete level base. This contractor shall furnish anchor bolts and dimensions for same to Concrete Contractor. Concrete Contractor shall set anchor bolts.

AUTOMATIC LINE TRANSFER CONTROL: The automatic line transfer control must be manufactured by the same company that makes the generator and have the necessary relays, component parts and a transfer switch which is electrically and mechanically interlocked to provide these functions:

1. With a large power outage, disconnect the load circuits from the main line, start the plant and transfer the load to the plant's output.
2. Upon power line return, transfer the load circuits back to the line and stop the plant.
3. Stopping, checking or providing automatic operation of the plant by means of a manual control switch.



The Control panel shall contain a fused 12-volt battery trickle charging circuit with a rheostat and ammeter to maintain the starting batteries fully charged. It shall include a 4-position switch to allow selection of the following operations each plainly marked - Automatic, Stop, Check and Hand Crank.

CRANKING LIMITER: A cranking limiter shall be provided to protect the batteries and starting circuit. It will open the starting circuit in approximately 45-seconds if the plant has not started within that time.

ACCESSORIES: All accessories needed for the proper operation of the set shall be furnished. These shall include starting batteries, battery cables, hand crank, muffler, exhaust tubing, fuel tanks, lines, and valves, etc.

This Contractor shall furnish and install the necessary valves and controls for the fuel line such as electric fuel solenoid, secondary regulator, dry fuel filter, shut off valve, primary regulator, etc. Plumbing contractor shall make connection to gas service ready for operation.

FOURTH BRANCH  
Hydraulic Operating Equipment

(See also "General Specifications of the Department of Public Works")

FORM OF BID: This Contractor shall submit an aggregate price for the labor, material, tools, and equipment of whatever nature required for the satisfactory installation of all work included under the branch, all in accordance with the drawings, these specifications and code rulings.

SCOPE OF WORK This contractor shall furnish all the labor, materials, tools, and equipment of whatever nature required for the satisfactory installation of the hydraulic lift equipment all in accordance with these drawings, specifications, and code rulings.

More specifically this contractor shall furnish and install the following:

All necessary power unit equipment, including hydraulic piping, hydraulic oil, and a quantity of two oil-hydraulic jack assemblies, one located in the center of each bridge pier, having a net lifting capacity of 30,000 pounds per jack unit at a total contract speed of 15 feet per minute.\* The total lift of each hydraulic jack assembly will be 15 feet 0 inches plus overtravel as required. Emergency power unit equipment at reduced elevating speed will also be provided.

\*A 5% variation in contract speed will be allowed, in both directions of travel. There will be absolutely no deviation from this requirement, since the owner expects proper speed control, regardless of load conditions on the bridge.

Permit for hydraulic lift equipment and inspection by State of Wisconsin and City of Milwaukee.

WORK BY OTHERS: Preparatory work in conjunction with the installations will be done by others, and will consist of the following:

Providing properly framed openings and concrete bases for the oil-hydraulic casings as indicated on engineering drawings. Providing properly lighted, heated and ventilated fire resistive machine room, floors and access doors, if required.

Supply electric feeder wires to terminals of the control and signal panels and include necessary main line switches, circuit breakers or fuses. Owner to furnish the required electric power for illumination, tool operation, testing and adjusting the lift equipment.

It will be the responsibility of other contractors to keep pits dry during the installation phase of the lift work, and also up to the time that the lift equipment is accepted by the owner.

DEFINITIONS: All terms in these specifications shall have the meaning as defined in accordance with the CS-202-56 Specification covering Industrial Lift and Loading Ramp Institute, and any local safety codes that may be applicable.

GENERAL CONDITIONS: The submission of a proposal will be considered as an acceptance of these specifications and conditions at the building site. Exceptions shall be grounds for the exclusion of the bidder's proposal.

DRAWINGS: Before beginning work, the lift contractor shall prepare all drawings necessary to show the general arrangement of the equipment and submit prints approval. These drawings must be approved before proceeding with fabrication and installation of the equipment.

INSPECTIONS AND TESTS: The lift contractor shall give all necessary notices, obtain all permits and pay all fees necessary in connection with the installation of this work. He shall arrange for inspection, and furnish without cost to the City all certificates necessary as evidence that work installed conforms with the before mentioned laws, ordinances and requirements. He shall also make tests as called for by the regulations of authorities and by these specifications. These tests shall be made in the presence of the authorized representatives of such authorities.

The successful bidder shall demonstrate that "Contract Speed" is provided for travel of lift bridge. The speed in either direction under all loading conditions shall not vary more than 5% of the contract speeds specified.

The contractor shall also be required to demonstration operation of lift bridge equipment in accordance with the "Performance Data" submitted on the "Specification Data" sheet.

DESCRIPTIVE MATERIAL: The intent of these specifications is to achieve a standard of lift performance and quality set forth herein.

It is understood that the same end result may be accomplished by means which could be standard only to an individual bidder.

For this reason, the bidder shall include with his proposal such descriptive literature as will illustrate and describe all equipment included in his proposal. The literature shall be identified by an attached letter of transmittal which identifies this literature as applying to equipment for this project.

The bidder should also include complete descriptive material on equipment or auxiliaries in optional proposals.

GUARANTEE: The lift contractor shall guarantee that the materials and workmanship of the apparatus installed by him, under these specifications, shall be first-class in every respect; and that he will make good any defects not due to ordinary wear and tear or improper use, which may develop within one year from the date of City of Milwaukee's final certificate.

In addition to the other requirements, inspections, tests and remedies herein provided, upon completion of the lift bridge installation and before final approval and final payment, the lift bridge contractor shall make, in the presence of the City of Milwaukee's designated representative, a running speed test with full maximum load on the lift bridge to determine whether the lift bridge equipment, as installed, meets the speed, capacity and all other requirements of the specifications. Furthermore, the City of Milwaukee will be the sole judge as to the acceptability of the lift equipment including leveling accuracy and smoothness of acceleration and deceleration.

In the event the equipment does not meet all requirements of the specifications, the lift contractor shall promptly remove from the premises all work condemned by the City of Milwaukee as failing to conform to the contract, and shall promptly replace and re-execute his own work in accordance with the contract, without expense to the City, and shall bear all expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

If the lift contractor does not remedy such condemned work within a reasonable time fixed by written notice from the City of Milwaukee, the City may correct such condemned work at the expense of the lift contractor and withhold such cost from final payment under the contract price. In the event the remainder due under the contract price is insufficient to cover such cost, the lift contractor shall, immediately upon request, reimburse the City in full.

PAINTING: All exposed metal work furnished under these specifications shall be given a shop coat of red lead touched up in field, and two field coats of paint by this (Lift) contractor all as specified in the Second Branch.\*

ELECTRIC SERVICE: The power supply will be 240 volts, 3 phase, 60 cycles, alternating current.

HYDRAULIC LIFT CONTRACTOR'S ELIGIBILITY: The City of Milwaukee has selected oil-hydraulic lift equipment for specific reasons and reserves the right to check the plant facilities and experience of the manufacturers and/or the distributors involved before making a final decision.

The City of Milwaukee also reserves the right to request detailed engineering information regarding the construction of the major components of the lift equipment, prior to award of contract.

Along with his bid, each lift contractor shall submit the names and locations of at least two similar installations, in operation for a period of at least two years. In particular, the installations listed must have speed and capacity ratings equal to or exceeding those specified.

MAINTENANCE: The lift contractor must include as part of his bid complete maintenance on equipment installed by him for a period of twelve months after final acceptance by the City of Milwaukee in accordance with the following:

In the evaluation of bids, consideration will be given to the proximity and extent of the maintenance offered by each contractor.

Contractors shall be able to show that they have had successful experience in the complete maintenance of lift equipment, employ competent personnel to handle this service, maintain locally an adequate stock of parts for replacement or emergency purposes and has qualified men available in Milwaukee, Wisconsin to insure the fulfillment of this service without unreasonable loss of time in reaching the bridge site.

This maintenance service shall be performed solely by the lift contractor, and shall not be assigned or transferred to any agent or subcontractor.

The Lift Maintenance Service to be provided is detailed as follows:

The Lift contractor shall supply all services, materials, labor, supplies, tools, and equipment required to completely maintain in first-class, smooth and quiet operating condition, the hydraulic lift equipment listed in the base specifications.

The lift contractor shall thoroughly examine and completely adjust the hydraulic lift equipment at monthly intervals as a minimum and more frequently if necessary to provide trouble free service. He shall clean and lubricate all parts of the apparatus in the machine room as required to maintain the lift equipment in proper working order and in neat and clean condition. Lubricants of the highest grade must be used.

In addition to the cleaning and adjusting work described, the lift contractor shall include in the service major and/or minor complete repair or replacement of electrical and mechanical parts of the lift whenever required. The scope of the service contemplates

the repair or replacement, among other items, of the machines, motors, controller parts, including bearings, magnet coils, rotating elements, pumps, valves, rams, cylinders, casings, etc.

In the event of an emergency, interruptions in the bridge service or indication that the lift equipment required immediate attention between the regular monthly examinations, the lift contractor shall be subject to call to correct the difficulty. He shall guarantee to have men on the job at the bridge site within four hours from the time the call for his services is received. This service shall be available to the owner without any extra charge for all material and labor required affecting minor repairs or adjustments to restore operation. The service shall be available upon a 24 hour, 7 day basis, at the disposal of the owner.

MULTI-SPEED LEVELING: An automatic two-way leveling device shall be incorporated, so that the lift bridge shall approach stops at reduced speed from either direction of travel, either up or down, and shall automatically level with an accuracy of  $1/8$ " plus or minus. Leveling shall be maintained as long as the lift bridge is within the leveling zone. One-way leveling, augmented with an anticreep device, will not be acceptable.

To absolutely establish the leveling procedure, let it be further stated that the lift bridge, when traveling in the up direction, will slow down as it enters the leveling zone, and then stop accurately without overshooting the established elevation. Also, in the down direction, the lift bridge will slow down as it enters the leveling zone, and then stop accurately at grade level.

OIL - HYDRAULIC CYLINDER UNITS: The cylinder units shall be designed and constructed in accordance with the CS-202-56 specification covering Industrial Lift and Loading Ramp Institute, any any local safety codes that may be applicable.

Lifting Capacity.....	30,000 lbs.
Sustaining Capacity.....	40,000 lbs.
Travel.....	15'0"
Speed.....	15 F.P.M.

The oil-hydraulic unit shall consist of two (2) plungers made of seamless steel tubing of not less than  $10-5/8$ " O.D., with finished wall thickness of  $5/16$ ".

The plunger shall be accurately turned and polished to a finish of 30 micro inches. A stop ring shall be electrically welded to the plunger to positively prevent plunger from leaving its casing.



The outer casing shall consist of seamless pipe of not less than .250 wall thickness with adequate pipe connection and air bleeder.

The guide bearings shall be provided with two (2) widely spaced steel rings electrically welded to a thick walled steel barrel. The bearing rings shall be faced with Babbitt metal to afford extremely smooth operation, positive plunger alignment during vertical travel, and prevention of plunger scoring.

The packing gland shall be made of malleable steel. Brittle cast or grey iron material shall not be acceptable.

The packing set shall consist of a molded synthetic rubber seal to contain the oil in the casing, with a built-in rustproof spring to afford proper tension for prevention of leakage during lowering of the jack units. The rubber seal shall be so designed with a special tapered lip surface to allow sufficient lubrication of plunger surface and also form a squeezing effect to eliminate water or foreign material from entering the hydraulic system.

The cylinder units shall be factory tested at 400 P.S.I. pressure.

Complete steel pit channels and bearing pads or brackets shall be furnished to properly mount and support the entire jack units.

POWER UNITS (MACHINES): Each power unit (oil pumping and control mechanism) shall be compactly and neatly designed, with all of the components listed below combined in a SELF-CONTAINED UNIT; structural steel OUTER BASE with TANK SUPPORTS; oil-tight DRIP PAN; INNER BASE for mounting motor-pump assembly; overhead OIL RESERVOIR with tight fitting TANK COVER; OIL FILL STRAINER and OIL LEVEL GAUGE ASSEMBLY, and a SELF-CLEANING STRAINER in the suction line; expanded metal SHEAVE GUARD; an oil-hydraulic PUMP; an electric MOTOR; a V-belt Drive Assembly; an OIL CONTROL UNIT; ELECTRIC CONTROLLER; and, SOUND INSULATING PANELS.

PUMP shall be specially designed and manufactured for oil-hydraulic lift service. It shall be of the rotary positive displacement type, inherently designed for steady discharge with minimum pulsations to give smooth and quiet operation. Output of pump shall not vary more than 10% between no load and full load on the lift bridge, and its mechanical efficiency shall be at least 85% under full rated load.

MOTOR shall be specially designed for oil-hydraulic service, shall be of standard manufacture, and of duty rating to comply with herein specified speeds and loads.

DRIVE shall be by multiple V-belts and sheaves of number and size for duty involved.

OIL CONTROL UNIT shall consist of the following components, all built into a single assembly. A SPEED CONTROL VALVE, a high pressure RELIEF VALVE, a SAFETY CHECK VALVE, an automatic unloading UP-START VALVE, an automatic unloading UP-STOP VALVE, a LOWERING VALVE, a LEVELING VALVE, a MANUAL LOWERING VALVE, and a TANK SHUT-OFF VALVE. All adjustments shall be accessible and shall be made without removing the assembly from the oil line.

SPEED CONTROL VALVE, to positively regulate the down speed, regardless of load on lift bridge, and within an accuracy of 5% plus or minus contract speed.

RELIEF VALVE (hydraulic overload protection) shall be externally adjustable, and shall be capable of by-passing the total oil flow without increasing back pressure more than 10% above that required to barely open the valve.

SAFETY CHECK VALVE shall be designed to close quietly without permitting any perceptible reverse flow. It shall be designed to support the lift bridge on a positive locked column of oil when bridge is at rest.

UP-START VALVE shall be externally adjustable, and shall be designed to by-pass oil flow during initial start of the motor-pump assembly. The valve shall close slowly, gradually diverting oil to the jack unit, insuring smooth up starts, and to relieve load on the motor during starting.

UP-STOP VALVE shall be externally adjustable and shall be designed to by-pass the oil flow to insure smooth up stops and to compensate for flywheel action.

LOWERING VALVE and LEVELING VALVE shall be externally adjustable for drop away speed, lowering speed, leveling speed and stopping speed to insure smooth down starts and stops.

MANUAL LOWERING VALVE shall be designed for manual lowering of the lift bridge in event of power failure and for use in servicing and adjusting the lift bridge mechanism.

TANK SHUT-OFF VALVE shall be designed for isolating oil in the power unit tank to insure ease of servicing and adjusting the elevator mechanism, without removing the oil from the tank.

SELF-CLEANING STRAINERS shall be provided for preventing foreign materials lodging in control system.

SOUND INSULATING PANELS shall be of 14-gauge steel, with 1" thick sound absorbent pads mounted on inside. These panels will totally enclose the power unit and will serve as guards as well. All panels must be mounted for rapid removal.

ADDITIONAL MACHINE FOR EMERGENCY SERVICE: In addition to the primary motor pump and valve assembly, a separate 5 h.p. maximum pumping unit assembly containing duplicate valve controls shall be incorporated in the primary power unit that will be available for emergency bridge operation service in the event local power service is interrupted to the bridge structure. This separate oil-hydraulic pumping unit assembly shall be powered from the emergency generator equipment as provided by others.

This contractor shall furnish and set the anchor bolts for anchoring the Power Units. Units shall be set on shock or anti-vibration mounts. Holes for anchor bolts may be drilled in concrete in field and set anchor bolts with cinch units.

CONTROLLERS: Electric controllers shall be of the full magnetic type, with silver to silver contacts on all relays and contactors. Thermal overload relays shall be provided to protect the motors against overloading. All components required for proper performance of the lift bridge, as specified under "Operation" section herein, shall be neatly mounted and wired on front of a steel control panel, and completely enclosed in a steel cabinet with hinged doors, mechanically locked. Control cabinet shall be designed for mounting on primary power unit, on limited service power unit, on wall, or floor stand. The electric control apparatus shall be completely isolated from the oil reservoir.

Reduced voltage starting equipment shall be provided to limit the starting current to a maximum of 33-1/3% of locked rotor current.

HYDRAULIC PIPING AND OIL: All necessary steel hydraulic tubing and fittings, including ball type flexible elbows of the proper size and pressure rating shall be provided to connect the power units to the jack units, together with hydraulic fluid of the proper grade.

Power unit locations are designated on engineering drawings. The lift contractor will be responsible for running hydraulic lines between power location and jack units. The City of Milwaukee will specify method of running these lines.

MAIN-LINE STRAINERS: A main line strainer and shut-off cock assembly of the self-cleaning type, equipped with a 60-mesh element, and a magnetic drain plug, shall be furnished and installed in each oil line. The unit shall be designed for 400 P.S.I. working pressure, shall be compact in design, with easy access for cleaning.

SPECIAL COMMENTS: All units have been designed to meet specific application requirements, also to meet specific bridge design problems. The lift contractor will not be allowed to deviate from clearances specified herein and on Engineering drawings. All design arrangements, clearances, dimensions, etc., have been verified and are fixed.

SPECIAL: In order for the City of Milwaukee to determine if all bidders are eligible, the following accompanying form should be filled out and submitted with the bid.

#### OIL-HYDRAULIC OPERATING EQUIPMENT FOR LIFT BRIDGE

##### MANUFACTURER AND DESCRIPTION

Primary Pump Motor	_____	HP	_____	RPM	_____	RATING	_____
Emergency Pump Motor	_____	HP	_____	RPM	_____	RATING	_____
Primary Pump	_____	GPM	_____	RPM	_____	HEAD	_____
Emergency Pump	_____	GPM	_____	RPM	_____	HEAD	_____
Relief Valves (Primary)	_____	Size	_____				
(Emergency)	_____	Size	_____				
Safety Check Valves (Primary)	_____	Size	_____				
(Emergency)	_____	Size	_____				
Up-Start Valves (Primary)	_____	Size	_____				
(Emergency)	_____	Size	_____				
Up-Stop Valves (Primary)	_____	Size	_____				
(Emergency)	_____	Size	_____				
Lowering Valves (Primary)	_____	Size	_____				
(Emergency)	_____	Size	_____				
Leveling Valves (Primary)	_____	Size	_____				
(Emergency)	_____	Size	_____				
Manual Lowering Valves (Primary)	_____	Size	_____				
(Emergency)	_____	Size	_____				

Tank Shut-Off Valves (Primary) \_\_\_\_\_ Size \_\_\_\_\_  
(Emergency) \_\_\_\_\_ Size \_\_\_\_\_

Main Line Strainers \_\_\_\_\_

Rams \_\_\_\_\_ Size \_\_\_\_\_

Jack Packing \_\_\_\_\_

Electrical Controllers \_\_\_\_\_

#### SIMILAR LIFT BRIDGE INSTALLATIONS

<u>Location</u>	<u>Type</u>	<u>Capacity</u>	<u>Speed</u>	<u>Travel</u>	<u>Date Installed</u>
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

RIVER TRAFFIC: River traffic on the Milwaukee River shall be maintained at all times without interruption. See requirements outlined on last page of Second Branch.

SCHEDULE OF WORK: This contractor shall start installation of the 5 H.P. gas operated hydraulic lifting machine on March 1, 1966 or in coordination with the work of the Second Branch Contractor in such a manner that the lift span can be raised hydraulically in the month of April and not later than May 1, 1966. This special scheduling of work is necessary so that the total project can be completed on time.

\*SCOTCH WRAP: Wrap all exposed piping between cylinders with Minnesota Mining and Metallurgical Co.'s Scotch Wrap No. 45, 0.006" thick, in double thickness by wrapping on in two passes.

FIFTH BRANCH  
Plumbing Work

(See also "General Specifications of the Department of Public Works)

FORM OF BID: This contractor shall submit an aggregate bid for the entire branch as herein specified in complete accordance with the plans and specifications.

RIGHTS RESERVED: The right is reserved to change the pipe, valves, equipment and sizes thereof or make modifications, to a reasonable extent as building conditions may require, or as may be required to conform to code rulings or manufacturer's standards, without extra cost to the City of Milwaukee.

SCOPE OF WORK: Furnish labor, materials, services and equipment for the complete installation of a plumbing and drainage system and other related work shown on the drawings and specified herein including but not limited to the following:

1. Working Drawings:

- Bulletins, data or detailed working drawings shall be submitted as may be requested to the Bureau of Bridges and Public Buildings in quintuplicate. Bulletins or drawings of the following shall be submitted within 20 days after awarding of contract.
  - a. Water closet with flush tank and service sink
  - b. Service sink faucet with vacuum breaker and trap
  - c. Paper holder and towel dispenser.
  - d. Toilet room partition and door.
  - e. Automatic storage water heater, vent and controls.
  - f. 5/8" water meter.
  - g. Complete piping layout of any deviations made from contract drawings.
  - h. Plumbing fittings on all fixtures.
  - i. Floor drain with extended pipe as shown.
  - j. Sewage ejector complete with basin and micro switch control.
  - k. Motor starter for sewage ejector.

- 2. Take all levels and measurements necessary for a perfect and complete assembling, building and installing of work.
- 3. Excavating and backfilling with limestone chips, sand and fine gravel as required for all Plumbing and drainage lines.
- 4. All drainage, vent and water pipes overhead or underground or floors as shown.



5. All test tees as required by code.
6. A 5/8" water meter.
7. Connect sanitary sewer line to existing sanitary in in W. St. Paul Avenue as shown.
8. Connect cold water to existing 8" water main in N. Plankinton Avenue as shown.
9. All cold water and hot water pipe lines with shut-off cocks ahead of each fixture, all sewers, drains, vent pipes, traps, air chambers, cleanouts, floor drains, pipe hangers or supports, valves, etc. for a complete plumbing and drainage system. Also all necessary standard stop and waste valves and drain plugs where shown or required by code.

Drains in and under driveways and connections to street are included in contract for plumbing work.

10. Automatic gas hot water storage heater complete with all controls, gas pressure reducer, etc.
11. Furnish, install and connect all gas piping to gas heating unit, hot water heater, and emergency generator with a gas cock shut-off at each connection.
12. Sleeves for all pipes passing through concrete or masonry walls, floors or ceiling.
13. Pipe insulation for hot and cold water lines, waste lines, water meter, etc., as mentioned or shown
14. Plumbing fixtures including water closet with flush tank, service sink, toilet room partition, etc., complete with all the trim such as paper holders, and paper towel dispensers, etc.
15. Cutting all openings as required and patching same.
16. Removing all rubbish, debris or surplus earth as caused by this work from premises.
17. Test for and eliminate leaks and water hammer troubles.
18. Run water supply lines and gas piping as shown on drawings.
19. Hangers, supports or anchors as required.
20. All valves, stops and drain valves and fittings as shown or required for a complete job.
21. Drawings of the completed job showing any deviation made from contract drawings. (A neatly marked blue-print of the contract drawings will be acceptable)
22. Arrange for City Plumbing Inspectors to be on the job when required.

MATERIALS INSTALLED IN THIS BRANCH BUT SUPPLIED BY OTHERS:

- Disconnect switch for sewage ejector by electrical contractor.

WORK EXCLUDED FROM THIS BRANCH:

1. Electrical Contractor will do all electrical wiring and make all final electrical connections, also will furnish and install electric heating cables for soil and water pipes.
2. The Heating Contractor shall furnish and install a complete heating system.
3. Gas meter outside and service to meter by Gas Company.

MATERIALS:

General:

- All materials, appliances and fixtures shall be new, the best of their respective kinds and in accordance with these specifications. Upon completion of job all parts shall be in perfect and undamaged condition free of flaws or defects. This Contractor shall be responsible for all damage done through any neglect in using the proper precautions for the protection of any material he furnishes or installs.
- The Bureau of Bridges and Public Buildings reserves the right to disapprove any material not felt to be satisfactory or meeting the requirements of the job intended.
- Only materials, appliances, or fixtures as approved or selected may be used.
- Manufacturers' catalog numbers specified are intended as a guide for the selection of materials and equipment. Other manufacturers' products which can be proven equal will be acceptable.

STANDARDIZATION OF EQUIPMENT:

1. Pipes and Fittings:

A. Soil, waste and vent pipes.

Note: All sewer pipe installed on this contract must conform to City of Milwaukee, Bureau of Sewers, Sewer Specifications, dated May 1, 1963.

1. Outside of Building:

- Vitreous clay sewer pipe where shown to conform to Bureau of Sewer Specifications, dated May 1, 1963.

- All copper piping under ground shall conform to A.S.T.M. Standard Specifications for seamless copper water tube, serial number B-88-61, Type "K". Remaining soil pipe A.S.T.M. Standard specifications for seamless copper water tube, type "L" Serial designation B-88-58

## 2. Inside of Building:

- Soil pipe Cast iron sewer pipe hub and spigot type conforming to Federal Specifications WWP401 Class A extra heavy and tarred.
- Steel pipe, couplings and nipples conforming to Federal Specifications WW-P-406, Type I, Class A, galvanized
- Pipe fittings for waste pipe, cast iron drainage, Federal Specifications WW-P491A, Type II coated
- Pipe fittings for vent pipes, cast iron, screwed, Federal Specification WW-P501B, Type I, Class A, black
- Provide lead or Stephenson #3 flashing for all vent pipes passing through roof unless otherwise shown.

## B. Water Piping

### 1. In Building, Exposed

- Hard drawn, Type L copper, A.S.T.M. B-88-61. Wrought coppersolder sweat fittings. Use 95-5 solder for all joints. Short branches and risers less than 3 feet may be soft copper.

### 2. Water Service Pipe from Water Main to Meter

- Soft temper Type "K" copper, A.S.T.M. specifications, Serial Number B-88-61

### 3. Gas Piping

#### 1. Black steel, schedule 40,

- Welded and seamless
- Fed. Specification WW-P-406, Type I, Class A
- All fittings malleable iron, 150 lb. screwed
- Pipe threads ASA B2.1

3. Water Meter

- 5/8" Badger Meter Company or approved equal meeting City of Milwaukee Water Works specifications.
- Basement type.
- Install as required by City of Milwaukee Water Works, Water Service piping specifications, drawing No. 13.

4. Ceiling Plates:

- On all pipes passing through finished floors, walls, or ceilings.
- Outside diameter sufficient to cover sleeve and inside to fit snugly around pipe.
- Solid ring type, metal, chrome or nickel-plated.

5. Hangers, Supports, Anchors:

- Support all piping in a neat and substantial manner, allowing for ample expansion and contraction
- Hangers to be iron swivel ring type with solid rods of proper size and a means of adjusting for height and "unistrut" type as shown.
- Concrete inserts are to be furnished and located by Plumbing Contractor set by concrete contractor.
- Where pipes are grouped with other pipes installed by other contractors, this contractor will furnish and install a trapeze with "U" spacers to hold pipe alignment.
- Perforated iron straps will not be allowed.
- Support vertical pipes with steel pipe clamps at floor or beams and wall brackets attached to walls with long "Cinch Anchors"

6. Cleanouts:

- Install at base of every soil stack or riser and in all roof conductors whether or not it is shown. Also, wherever there is a change in direction of sewer or waste pipe run and at the ends of these lines.
- In straight runs of sewer or waste install a cleanout every 75 feet.
- In floors or walls where there will be any foot traffic, use flush type cleanouts with a flush brass "Code" plug.

7. Traps:

- To conform to Milwaukee Plumbing Code Section 40-11
- Each fixture shall be separately trapped.
- Material cast brass.
- Place as near to fixtures as practicable and not further than two (2) feet.
- Same size as pipes they are connected with.
- With brass clean out plugs.

- Buried traps in or below floors of extra heavy cast iron tarred in and out complete with necessary fittings.

8. Stop Cocks; Drain Cocks and Faucets:

- At every fixture provide a stop cock in hot and cold water supply in an inconspicuous, yet, accessible position.
- At every riser install a drain plug.
- All faucets shall be of the type that close with the pressure, and have easily removable operating units, equal to those of the Chicago Faucet Company or Crane Dialese.

9. Roof Flashing:

- Lead (4 lbs. per sq. ft.) or copper (16 oz. per sq. ft.)
- To extend at least 8" beyond pipe all around
- Or Stephenson #3 flashings.

10. Unions:

- Cast bronze ground joint.
- For all fixture connections, or wherever else noted or required for proper piping and equipment installation and removal.

11. Valves and Check Valve:

- Crane, Milwaukee Valve or approved equal.
- Must conform to Federal Specifications WWV-54 rising stem and WWV-0051-1A.
- 125 lb. working pressure.
- Bronze gate.
- Check valve, Anaconda Fig. No. 1784, copper to copper, or approved equal.

12. Sleeves:

- Provide galvanized steel sleeves of proper size and lengths for all piping passing through walls, concrete, partitions, floors and ceilings.
- Pack space between pipe and sleeve with oakum. Apply waterproof plastic asphalt joint compound at faces of opening. Waterproof and seal on outside face of all walls.

13. Floor Drain:

- Zurn Z-415V Triumph, or approved equal.
- 3" I.P.S. Bottom outlet.
- Type "X" Strainer to fit
- With back water valve.

14. Water Closet:
- American Standard F2050-61 elongated compact, or approved equal.
  - Vitreous china free standing close-coupled combination.
  - Siphon jet bowl.
  - Black open front seat, less cover.
15. Service Sink:
- American Standard P7705-1 Argo, Kohler K-6716-A Bannon, or approved equal.
  - Acid resisting enameled cast iron.
  - Supply fitting Chicago No. 305VB with vacuum breaker, or approved equal.
  - Bucket hook, threaded spout and protecting chrome plated rim.
  - Trap, American Standard P-7798 or approved equal
  - 3" enameled inside with strainer
  - Minimum size 24" x 24", 12" deep, back 12" floor to rim 27".
16. Hot Water Heater:
- Day and night 20JSF Starfire, or approved equal.
  - Capacity 27,000 B.T.U./hr. input of natural gas, 22.7 gal./hr. of water at 100° F. temperature rise.
  - Storage capacity, 20 gal.
  - Tank, steel, glass or vitreous enamel lining, insulated with fiberglass and jacketed.
  - Magnesium anode rod.
  - High limit control and 100% safety shut-off.
  - Gas pressure regulator and draft diverter.
  - Guarantee, 5 years unconditional.
  - Approved and labeled by A.G.A.
  - Temperature and pressure relief valve as required by code.
17. Submersible Sewage Ejector, Pump and Basin:
- Weill Pump Co. Unit No. SE-811, or approved equal
  - With Micro switch control.
  - Motor, 1/2 H.P., capacitor type, 1750 R.P.M., 220 volt, single phase.
  - Automatic overload switch built in
  - Stainless steel shaft.
  - 3" discharge.
  - Basin, 36" in. dia. X36" high, cast iron.
  - Basin cover, 36" (AB" T. 40", O.D.)
  - Magnetic Starter, Square D Co. size "0", 2 pole, Class 8536, or approved equal.



18. Toilet Room Partitions:

- Milwaukee Ferrometal Stamping Corp. or approved equal.
- Floor mounted.
- Dividing partition 57", not less than 1" thick, 20 ga. stretcher leveled zinc coated and bonderized, sound deadening and reinforcing core cemented in, edges of sheets welded on 12" centers, corner joints mitred, brazed or welded and ground smooth.
- Pilasters 1-1/4" thick, 16 ga. steel sheets zinc coated and bonderized, assembled with sound deadening core, otherwise similar to dividing partitions
- Headrail 1" x 1-3/8" 18 ga., electric welded tubing to set inside at top of pilaster.
- Doors 22 ga. steel otherwise same construction as divider partitions, internally welded box reinforcements for hinges and latches, hinge body concealed in door, bottom edge of door to align with front pilaster in closed position.
  - Finish on thoroughly cleaned surfaces, primer and color coat sprayed on minimum 1 1/2 mils. thick and baked at 300° F.
  - Hardware, all doors - concealed matchless gravity hinge outside adjustable, inset top pivot assembly, throwlatch, slide latch, or concealed latch, strike and keeper, hinge brackets, coat hook and bumper, 18-8 stainless steel ceiling and floor shoes, hardware chrome plated.
  - Color to be chosen later.

19. Paper Holder: At water closet

- Hallmack No. 871, or approved equal
- Chrome or nickel plated brackets
- Black wood roller.

20. Towel Dispenser:

- Dengel's GRIF-HO, Model T-500 SR, or approved equal
- Smooth dispensing qualities, rigid steel construction
- Spring latch construction, with key to open
- Finish of Synpor white baked enamel.

21. Insulation:

- In bridge house and exposed outside, including all piping under bridge down to F/L Elev. 7.33 all as shown and noted. Install as per manufacturer's recommendations.

- a. Piping: Soil, Waste, hot and cold water lines.
  - Johns-Manville metal-on, aluminum jacketed calcium silicate, or approved equal.
  - .016" aluminum minimum thickness of jacket.
  - Provide moisture barrier between insulation and aluminum jacket.
  - Provide a positive weatherproof seal along entire length of the aluminum jacket.
  - .016" minimum thick aluminum strap with weatherproof sealant shall be centered over each circumferential joint and secured in place with a 11/16", No. 302 stainless steel band, .010" minimum thickness, or approved equal.
  - All fittings i.e., elbows, tube turns, sweeps and bends shall be installed per method recommended by manufacturer.
- b. Valves and Fittings:
  - Insulate with fiberglass O-C110 mineral wool insulating cement, or approved equal.
- c. Water Meter:
  - One pound density Aerocor or Hairfelt applied in two 1" layers. Each layer vapor-sealed with a fiberglass membrane. Fabric or glas-fab or equal
  - Finish with insulating cement reinforced with 1" mesh chicken wire and troweled to smooth finish with a vapor sealing mastic.
- d. Canvas:
  - Vapor-seal all piping valves and fittings with white, vapor barrier lap cement and 8 oz. canvas

WORKMANSHIP:

1 General:

- Any work done under this contract shall be executed in a thorough, substantial and workmanlike manner. Only experienced mechanics shall be employed.
- Exact locations determined in field.
- No change in pipe size without approval.
- Complete drawings and all information must be submitted before work is begun.
- Drawings show general location of piping which shall be adhered to unless otherwise approved.
- Close all pipe openings, etc., with proper caps and fittings to prevent obstructions in or damage of any kind while the building is in the course of alterations.
- Protect all fixtures during installation.
- Damaged fixtures must be completely replaced.
- Repaired fixtures not acceptable.

## 2. Excavating and Backfilling:

### a. Excavation:

- Includes the removal of all debris, earth, loose rock, old fill, trees, shrubs, and concrete with the spaces to be excavated.  
Should any old walls, floors, wells, pits, or old debris be found within the spaces to be excavated, they should be included as "excavation" or earth and removed by the contractor.  
All material excavated and not suitable for backfilling as hereinafter specified, shall be removed from the premises and disposed of by contractor in accordance with City ordinances.
- All trenches must be left open until all piping has been approved by Plumbing Inspector and Sewer Inspector and tested for leaks.
- Barricade in accordance with safety regulations and City ordinances.
- Contractor should note that trench excavation might include old rock and concrete fill.

### b. Shoring

- Open cut trenches shall be sheathed and braced as required by the Industrial Commission code, by the plans and specifications, by the City of Milwaukee Bureau of Engineers, Department of Public Works, Sewer Specifications and as may be necessary to protect life, property or the work.

### c. Backfilling:

- Refer to City of Milwaukee Bureau of Engineers, Department of Public Works Sewer Specifications for backfilling material and procedure.
- Backfill of trenches bank run gravel up to finished subgrade unless otherwise noted
- Backfill to be laid in layers not over 1 foot thick and each layer thoroughly soaked and tamped before covering with another layer.
- Repair all damage to streets, curbs, sidewalks, etc., caused through this work in a manner acceptable to the Commissioner of Public Works.

## 3. INSTALLATION OF PIPING:

- Drainage lines to be installed in accordance with City of Milwaukee Bureau of Engineers, Department of Public Works Sewer Specifications.
- Water meter and piping to be installed in accordance with Water Department Specifications.

- All piping must be new, free from holes and of uniform thickness.
- Conceal all pipe wherever possible. Where pipes pass through finished walls or floors use one piece chromium plated ceiling plates.
- Run all pipes except vents in warm areas where there is no danger of freezing. Where this is impossible, pipes shall be cased with zero or approved equal frost proofing insulation.
- Support pipes from walls or ceilings, use cinch anchors, concrete inserts or equal in concrete or masonry construction, with Grinnell or equal .  
copper ring hangers with adjustable rod supports or as shown otherwise.
- Beams, joists or any other important structural member shall not be cut, notched or drilled into, unless approved or specifically stated.
- Necessary compression stop and waste valves, shown or required.
- Place drain valves on bottom of risers and pitch all lines for complete drainage.
- Plug all open pipes during construction.
- Systems to be free from pockets, depressions or defects
- Pipes to run parallel to walls.
- Protect all piping, traps, and connections going through or into concrete with asphaltum coat of tar paper or both.
- Pitch drain piping at least 1/4" per foot, or as approved.
- Tag all valves with fibre tags.

#### 4. Joints

- Thoroughly clean and ream pipe after cutting.
- For copper pipe use solder with 95% tin and 5% antimony with a paste flux of petrolatum base impregnated with zinc and ammonium chlorides .
- Use non-corrosive flux.

#### 5. Swing Joints:

- On all hot and cold lines where fixture to be served is less than eight (8) feet away from main.

#### 6. Protection:

- All open pipes, pipe threads, fixtures, fittings and all equipment furnished by this contractor must be properly protected during construction.

- No repaired or imperfect fittings or equipment will be accepted. If any argument should arise in regard to this requirement, the City Hall will replace the parts and deduct the costs from the contract price.
7. Openings, Cuttings, and Patches: As required for this branch:
- Cooperate with other trades and adjust with them (subject to approval of Bureau of Bridges and Public Buildings) all questions of interference.
  - Make all arrangements with other contractors for any special framing spaces or chases.
  - In event that holes must be cut they must be drilled with a rotary drill, to avoid spalling and unnecessary damage or weakening of structure.
  - Chopping or breaking out will not be allowed.
  - Before drilling through concrete obtain Inspector's permission and proceed as directed.
  - Any damage resulting from this work must be repaired to match existing construction to the satisfaction of the City Inspector in charge.
8. Installation of Fixtures:
- Mount hangers rigidly
  - Bottom of closet to be caulked
  - Must be level.
9. Installation of Insulation:
- a. All pipe runs
- Pipe must be clean and dry.
  - Adjoining sections firmly butted together.
10. Tests:
- For leaks, proper operation, drainage, elimination of all water hammers, expansion, etc.
  - All fixtures, and any equipment furnished and installed by this contractor must function perfectly.
  - If any faults are found this contractor shall repair or replace any of the parts he has furnished or installed as directed without any additional cost to the City of Milwaukee.
  - The work shall be cleaned of any and all blemishes and stains and left in a condition acceptable to the City within the normal limits of the work specified.

11. Repairs:

- This contractor to repair all damages that he, any of his employees or his subcontractors may do to any of the other work.
- Repairs done in a neat and workmanlike manner to match existing construction.
- Must meet with approval of Commissioner of Public Works or his representative.

12. ELEVATIONS:

- All elevations given are to be checked by this contractor.
- Any major changes which may conflict with required pitch shall be reported to the Bureau of Bridges and Public Buildings immediately.

13. Temporary Water Supply:

- Water shall be provided by the Plumbing Contractor near the bridge from a tap on the line which is to be used later to provide water for the bridge house. All water used will be paid for by the City of Milwaukee. Water for use of all contractors.
- Maintain throughout building operations.
- Install temporary water meter as necessary.
- Remove all when directed.
- Other contractors will provide their own hose or other piping.
- All other charges connected with this temporary supply shall be paid for by Plumbing Contractor.

14. Pumping:

- The Contractor shall include all pumping and bailing that may be required to keep all excavated spaces and trenches clear of all water from rainfall, seepage, or other ordinary causes during the progress of the work. Pumping and bailing shall be understood to include all apparatus, fuel, attendance, and labor for the purpose of operating same.



## SIXTH BRANCH

### Heating

FORM OF BID: This contractor shall submit an aggregate price for the labor, material, tools and equipment of whatever nature required for the satisfactory completion of all work included under this branch, all in accordance with the drawings and these specifications and all code requirements.

SCOPE OF WORK: Furnish labor, materials, services and equipment for the complete installation of a heating system and other related work as shown on the drawings and specified herein, including but not limited to the following:

1. WORKING DRAWINGS:

- Bulletins, data or detailed working drawings shall be submitted as may be required to the Bureau of Bridges and Public Buildings in quintuplicate; bulletins or drawings following must be submitted within 20 days after awarding of contract on the following items:
  - a. Gas-fired furnace.
  - b. Extruded aluminum, double deflection registers.
  - c. Flue piping, roof flashing, metal bird-proof cap, storm collar, etc.

2. Taking all measurements, checking all dimensions, etc.
3. Gas-fired furnace complete with all controls, thermostatically controlled for completely automatic operation.
4. Flue piping for furnace and gas water heater all as specified and shown.
5. All aluminum ducts and extruded aluminum, double deflection registers as specified and shown.
6. Operating and maintenance instructions

WORK TO BE DONE BY OTHERS:

1. Furnish and install gas piping and make final connection to furnace.
2. All electrical wiring.

MATERIALS:

General:

- All materials, appliances and fixtures shall be new, the best of their respective kinds and in accordance with these specifications. Upon completion of job all parts shall be in perfect and undamaged condition free

of flaws or defects. This contractor shall be responsible for all damage done through any neglect in using the proper precautions for the protection of any material he furnishes or installs.

- The Bureau of Bridges and Public Buildings reserves the right to disapprove any material not felt to be satisfactory or meeting the requirements of the job intended.
- Only materials, appliances, or fixtures as approved or selected may be used.
- Manufacturers' catalog numbers specified are intended as a guide for the selection of materials and equipment. Other manufacturers' products which can be proven equal will be acceptable.

1. Furnace

- Mueller Climatrol Model No. 144-65, or approved equal meeting the following minimum specifications:
- Gas-fired.
- Must have L.H. side filter rack
- A.G.A. approved.
- Input; 65,000 B.T.U.
- Bonnet output, 52,000 B.T.U.
- Air delivery, 865 C.F.M. at .3 static pressure and 85° temperature rise.
- Insulated steel cabinet.
- Cast iron burners.
- Welded steel heat exchanger.
- Thermostat.
- Programmed gas valve consisting of safety pilot and pressure regulator.
- Main and pilot gas cocks.
- Draft diverter.
- Replaceable filter.
- Centrifugal blowers
- Variable motor speed control.
- Self-aligning fan bearings.
- Motor, 1/6 H.P., 115 bolt, 60 cycle, with built-in overload protection
- Complete for fully automatic operation with thermostat and automatic gas valve to start and stop unit automatically.
- Fan and limit control. Adjustable fan control that turns the blower on automatically when the furnace reaches a pre-determined temperature. The limit control shall shut off the burner automatically when the air temperature reaches control setting.

- Starting Service
  - Provide the City of Milwaukee with the services of a qualified man for the starting of the unit.
  - Complete instructions with wiring diagrams.
- 2. Flue Piping
  - Metalvent pipe and fittings, or approved equal.
  - Must comply with Underwriters' Laboratory standards.
  - Double wall metal construction, galvanized outside pipe and aluminum inside pipe.
  - Roof flashing, storm collar and top cap, install as shown.
- 3. Heat Supply Ducts and Turning Vanes
  - Minimum thickness, 22 ga.
  - Aluminum.
- 4. Supply Registers
  - Extruded aluminum.
  - Double deflection with opposed blade damper.
  - Carnes Model 200, or approved equal.

WORKMANSHIP:

General:

- Any work done under this branch shall be executed in a thorough, substantial and workmanlike manner. only experienced mechanics shall be employed on this project.
- Close all pipe openings with caps and fittings to prevent obstructions in or damage of any kind.

Correct: George E. Ashton

Superintendent: Bureau of  
Bridges and Public Buildings

Approved: Walter H. Parker  
Deputy Commissioner of Public Works